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[SHTAKEL'BERG.] STACKELBERG (A. A.). **A new Species of the Genus *Carcellia* (Diptera, Larvivoridae) from the Ussuri Land.**—*C. R. Acad. Sci. URSS* (N.S.) **39** no. 4 pp. 163–164. Moscow, 1943.

Carcelia pavlovskyi, sp. n., is described from a single male reared from a larva of the Limacodid, *Monema flavescens*, Wlk., in the Russian Far East, and a new subgenus, *Megacarcellia*, is erected for it.

THOMANN (H.). **Ueber Erdraupenschäden im Sommer 1943 an Tabak und Mais im Graubündner Rheintal.** [Injury caused by Cutworms to Tobacco and Maize in the Rhine Valley in the Canton of Grisons during the Summer of 1943.]—*Mitt. schweiz. ent. Ges.* **19** no. 4–5 pp. 169–179, 8 figs., 18 refs. Berne, 1944.

In July 1943, cutworm injury to tobacco and maize, and in one case to cabbage, was reported from various localities in the Canton of Grisons. The tobacco stems were cut through at the level of the soil surface or just below it, and although many plants produced new shoots, damage was so severe that one plantation of about five acres was entirely destroyed. Maize was less severely damaged, but many fields showed serious injury. The only cutworm present was *Agrotis ypsilon*, Hfn., although *A. exclamationis*, L., and *Euxoa* (*A.*) *corticea*, Schiff., are usually the most abundant in this district. It has frequently been observed in Switzerland, but has not hitherto been recorded as injurious there, and the outbreak was probably the result of the hot, dry summers of 1942 and 1943.

The bionomics, distribution and economic importance of *A. ypsilon* in Europe are discussed from the literature, and preliminary investigations on its control on tobacco are described. Effective treatments included Gesarol [of which the active principle is 2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane], applied as a dust or a 2 per cent. spray. The dust adhered readily to the tobacco leaves and was easier to apply, but the spray would probably be the more effective on maize, as it would penetrate to the underground borings of the cutworm in the stem.

WIESMANN (R.) & FENJVES (P.). **Autotomie bei Lepidopteren und Dipteren nach Berührung mit Gesarol.** [Autotomy in Lepidoptera and Diptera after Contact with Gesarol.]—*Mitt. schweiz. ent. Ges.* **19** no. 4–5 pp. 179–184, 1 fig. Berne, 1944.

In the course of experiments with Gesarol, which acts chiefly as a contact poison, small numbers of adults of *Operophtera* (*Cheimatobia*) *brumata*, L., *Sitotroga cerealella*, L., and *Culex pipiens*, L., were put in petri dishes bearing a dry deposit of the active ingredient [2, 2-bis (parachlorphenyl)-1, 1, 1-trichlorethane]. This was not powdery and so was not rubbed off the tarsi of the insect on to other parts of the body. All the treated insects made violent movements and cast a number of legs ; they became paralysed within a few hours and died, *Operophtera* and *Culex* within 48 and 12 hours, respectively. It is concluded that contact of the tarsal sense-organs with the deposit irritated the nerves of the legs and also the locomotive centre so severely that the legs were discarded in an attempt to escape the source of irritation, and that this irritation was the cause of paralysis and death.

LEBARRON (R. K.). **Influence of controllable environmental Conditions on Regeneration of Jack Pine and Black Spruce.**—*J. agric. Res.* **68** no. 3 pp. 97–119, 7 figs., 28 refs. Washington, D.C., 1944.

An account is given of an investigation begun in 1937 on the influence of the density of tree cover and of the lower ground cover, the character of the soil surface, and seed-destroying rodents and birds on the production of seedlings of jack pine (*Pinus banksiana*) and black spruce (*Picea mariana*) in the upland areas of north-eastern Minnesota. In a short section dealing with insects (pp. 110–111), it is reported that these were by far the most important source of seedling losses, killing about 26 per cent. of all the jack pine that germinated and 41 per cent. of the black spruce, half the total mortality. Those observed feeding on the tops of young seedlings included *Camnula pellucida*, Scud., and larvae of *Harmologa* (*Cacoecia*) *fumiferana*, Clem., and of species of *Halisidota* and *Empria*. A few seedlings were killed by larvae of *Lachnosterna* (*Phyllophaga*). Loss of tops and cotyledons through insect activity began immediately after the first seedlings appeared (in May or early June), and continued through July and August. Mortality due to insects was affected very little by tree cover, and was not appreciably greater on unweeded than on weeded plots, probably because the low vegetation was rather sparse during the early part of the first growing season, owing to the recent soil surface preparations, and had little effect on the insects until most of the damage was done. It varied to an unexpected extent with soil surface, however, possibly because most insects attacked seedlings in places where they had hibernated as eggs or larvae in litter on the ground. Losses were low on mineral soil, from which the litter was removed before sowing, and on surfaces on which it was burnt with a torch, to simulate conditions after a forest fire, and higher on undisturbed soil and on soil that was scarified and shaded with sticks concealing approximately 75 per cent. of the surface to simulate the shading effect of a light layer of logging slash, which may have protected the insects. The greater kill of black spruce is probably due to the smaller size of the seedlings, because of which they are easier to kill and more are required to provide a given quantity of food.

PACKARD (C. M.). **Insect Enemies of our Cereal Crops.**—*Rep. Smithson. Instn 1942* pp. 323–338, 19 pls. Washington, D.C., 1943.

The author estimates that the annual losses caused in the United States by some of the major field pests of cereals and by insects in stored grain are at least 244 and 365 million dollars, respectively. He briefly discusses the savings effected by control measures to illustrate the value of research, and describes methods of protecting the crops, including the development of plant varieties resistant to insects, and the use of mechanical, cultural and biological control measures, chemical and mechanical barriers and insecticides.

CROMBIE (A. C.). **The Effect of Crowding upon the Natality of Grain-infesting Insects.**—*Proc. zool. Soc. Lond.* (A) **113** pt. 3–4 pp. 77–98, 4 figs., 45 refs. London, 1944.

A detailed account is given of experiments with *Tribolium confusum*, Duv., and *Oryzaephilus surinamensis*, L., and the results of other investigators are reviewed from the literature. The beetles (usually equal numbers of both sexes) were kept at 30°C. [86°F.] and a relative humidity of 70 per cent. in flour that had been kept at this temperature and humidity for at least a month. The females used had first been each caged with two males for a fortnight to provide opportunity for sufficient mating, and then tested for fecundity over a period of one week ; those with a fecundity outside the limits of 10–12 eggs per day in the case of *Tribolium* and 3–4 in that of *Oryzaephilus* were rejected.

The following is based largely on the author's summary. Fecundity of *Tribolium* was reduced by interference with gravid females resulting from competition for the limited space available for oviposition at densities above 1·25 adults per gm. flour, but remained fairly constant at densities of 0·0195–1·25 adults per gm., and that of *Oryzaephilus* was reduced at densities above

10 adults per gm. The effect of density was immediate in both species, and in neither was the fertility of the eggs affected by it. The proportion of eggs eaten in a given time by the adults of each species was directly proportional to the density of adults, and the decrease with increasing density in the number of eggs found per female-day is attributed partly to the higher rate at which eggs were eaten and partly to the effect of crowding on fecundity over certain ranges of density. Females of *Tribolium* did not oviposit in the absence of flour, but those of *Oryzaephilus* did so when the dishes containing them were provided with muslin covers, through which the eggs were laid; the rate of oviposition was considerably reduced in the absence of flour, probably in part owing to starvation. When both species were present together, the number of eggs per female-day decreased with increasing densities, but the decrease was less in the case of *Tribolium* and greater in that of *Oryzaephilus* than when the females were competing only with their own species. This is attributed to the greater interference by adults of *Tribolium* with gravid females of both species and to the greater extent to which adults of *Tribolium* prey on eggs.

Further experiments were made with media composed wholly or in part of flour in which populations of *Oryzaephilus*, *Tribolium* or *Rhizopertha dominica*, F., had previously been living. In general, fecundity decreased in both *Tribolium* and *Oryzaephilus* as the percentage of flour conditioned by any of the three species increased, the fertility of the eggs being unaffected, but fecundity became normal again when the adults were returned to fresh flour; recovery from all media was complete in four days.

It seems probable that the rate of growth of populations of each species and the outcome of competition between them depends on their relative rates of cannibalism and predation, and that there is a tendency for *Oryzaephilus* to be suppressed in competition with *Tribolium* because its rate of cannibalism and predation is the lower, it does not prey on the pupae of *Tribolium*, whereas its pupae are attacked by both adults and larvae of this species, and the adults are largely confined to the surface layers, whereas those of *Tribolium* move throughout the whole medium; larvae of *Oryzaephilus* do not attack eggs of *Tribolium* and therefore only those eggs present in the superficial layer are destroyed by *Oryzaephilus*. It was found that the average weights of food consumed by a larva during its development and by an adult male and female per week were 6·75, 2 and 2·25 mg. for *Oryzaephilus* and 26, 2 and 3 mg. for *Tribolium*.

WALKER (M. G.). **Notes on the Biology of** *Dexia rustica* **F., a Dipterous Parasite of** *Melolontha melolontha* **L.**—*Proc. zool. Soc. Lond.* (A) **113** pt. 3–4 pp. 126–176, 15 figs., 21 refs. London, 1944.

In an attempt to investigate the possibility of the biological control of white grubs in Great Britain, examinations were made of large numbers of larvae of *Melolontha melolontha*, L., *Amphimallon* (*Amphimallus*) *solstitialis*, L., *Anomala* (*Phyllopertha*) *horticola*, L., and *Serica brunnea*, L., received from various localities, chiefly forest nurseries, where they were collected in 1937–41. The only parasite recovered was *Dexia rustica*, F. Data from the field collections are set out in a table and analysed under the headings of geographical distribution, the numerical distribution of parasites among hosts, and variations in degree of parasitism due to seasonal and other causes, and the results of laboratory investigations of the bionomics are given in detail, together with descriptions of the methods of rearing the parasites and inoculating the host larvae.

The parasite was most common in *M. melolontha*; larvae of *Amphimallon solstitialis* were not very numerous, but parasitised individuals were common among them. *Anomala horticola* was rarely attacked in the field, and *S. brunnea* not at all. About 80 per cent. of the larvae of the first three species that were exposed to attack in the laboratory became parasitised, but attempts to induce parasitism in *S. brunnea* were unsuccessful. Parasitised larvae can be distinguished by a black mark, representing the chitinous respiratory funnel of the parasite, at the point of penetration into the host. The presence of *D. rustica* was almost invariably associated with that of *M. melolontha*, but it appears to be restricted to the region south of the Mersey Estuary, although *M. melolontha* occurs farther north. A high proportion of the host larvae escaped parasitism altogether, but intense superparasitism occurred among those that did not, due to the tendency of the female parasites to deposit their eggs in batches or to the inaccessibility to the young larvae of many host larvae that were deeply buried or to a combination of both factors.

D. rustica has one generation a year and the adults emerge in summer. At the end of July, parasitism was absent or low, but it increased at first slowly and then more rapidly from mid-August until September and October, after which it was lower, but still high, until the beginning of July. An apparent increase in percentage parasitism at the end of June was caused by the onset of pupation since only unparasitised larvae are able to pupate. The degree of parasitism was very variable, it was generally higher in cultivated ground than in turf or waste ground, and, among nursery beds, was highest in those in which the ground had been well cultivated shortly before the oviposition period. It was lowest in beds containing three-year-old trees, where the depth at which suitable food for the host larvae was present was greatest. Some indication was obtained that only turf that is consolidated by constant use is unsuitable for oviposition by *D. rustica*. In places where the broods of *Melolontha* do not overlap, the host population in the autumn of the flight year consists mainly of very small larvae, which either are unsuitable for parasitism or cannot be detected by the parasite larvae ; the percentage parasitism in them is consequently low, and it is doubtful if many of the parasites in them reach maturity. The parasite population is therefore subject to a marked reduction, which does not occur in places where the beetles are in flight every year. In the laboratory, mortality as high as 90 per cent. occurred among parasites developing in small host larvae.

The adults vary in size, the large individuals developing in larvae with only one or two parasites and the small ones in small or heavily parasitised hosts. The males survive for 3–4 weeks and the females about a week longer. The eggs are deposited on the soil, and the larvae hatch from them barely a minute later and burrow into the soil in search of a host, into which they penetrate at any point on the thorax or abdomen, usually on the dorsal surface. Laboratory experiments did not afford satisfactory evidence of the way in which an ovipositing female locates a host or the extent to which it restricts oviposition to soil containing one, but the burrowing instinct of the larva appeared to be less strongly marked in the absence of a host larva. Soil with a moisture content of about 4 per cent. appeared to be most favourable for the location of host larvae. Mortality among the parasite larvae was high, particularly during and immediately after penetration and if the host larva died prior to the emergence of the parasite from it. Puparia were formed two days after the parasite larvae had left the host. The average size of the puparia was less as the number of parasites per host increased, and the rate of survival also decreased. Emergence took place after 20–35 days, and there was a tendency for the males to emerge first ; emergence from a group of puparia containing larvae that had developed in the same host was generally complete in 2–3 days. The sex ratio was approximately equal, but the proportion of females decreased steadily as the number of puparia per host increased. Large females contained more eggs than small ones.

The investigations show that *D. rustica* is able to exert only limited control of white grubs and there is little likelihood of any increase in parasitism in the areas studied owing to the inaccessibility of a high proportion (70–75 per cent.)

of the host larvae. The elimination of permanent grass paths and waste patches in nurseries is likely to facilitate the location of the host by the parasites, particularly if digging is performed in July, and treatments, such as the application of soil fumigants in summer and autumn, that are likely to destroy parasitised larvae and those near the surface of the soil, should be avoided.

Consignments of parasitised white grubs were shipped by sea to Mauritius with a view to establishing the parasite against *Clemora* (*Phytalus*) *smithi*, Arr. [*cf.* *R.A.E.*, A **26** 317], and in one sent before the outbreak of war, survival was as high as 90 per cent. Under war conditions, the length of the journey was extended, and only 10 per cent. of the larvae survived.

SHENEFELT (R. D.). **The Genus *Atanycolus* Foerster in America north of Mexico.**—*Res. Stud. St. Coll. Wash.* **11** no. 2 pp. 51–156, 4 pls., 1 diagr., 43 refs. Pullman, Wash., 1943.

In discussing the use of the name *Atanycolus* for the genus that is the subject of this revision instead of *Coeloides*, which Viereck considered applicable to it, the author acknowledges access to Muesebeck's unpublished notes regarding the genotype of the latter. Wesmael designated *Bracon initiator*, F., as the type of *Coeloides*, but the insect he had before him was not in fact *B. initiator*, which belongs to the genus *Atanycolus*, but *C. scolyticida*, Wesm. The author therefore designates *C. scolyticida* as the type of *Coeloides*, so that the names *Coeloides* (*Coeloidina*, Vier.) and *Atanycolus* have the same connotation as they had to their authors and subsequent writers.

The new species described include the following, all from the United States : *A. longifemoralis* reared from *Melanophila drummondi*, Kby., *M. gentilis*, Lec., and *Hylotrupes* sp. ; *A. melanophili* from *M. fulvoguttata*, Harr. ; *A. octocolae* from *Chrysobothris octocola*, Lec. ; *A. tranquebaricae* from *C. tranquebarica*, Gmel. ; *A. malii* from *C. mali*, Horn ; and *A. femoratae* from *C. femorata*, Ol.

HINCKS (W. D.). **Notes on the Nomenclature of some British parasitic Hymenoptera.**—*Proc. R. ent. Soc. Lond.* (B) **13** pt. 3–4 pp. 30–39, 20 refs. London, 1944.

New or next available names for preoccupied genera include *Ipoctoninus*, n.n., for *Ipoctonus*, Först. ; *Sagaritopsis*, n.n., for *Sagaritis*, Hlmgr. ; and *Dapsilarthra*, Först., for *Adelura*, Först. Among other genera of which the nomenclature is discussed are *Aptesis*, Först. 1850 (*Microcryptus*, Thoms. 1873, *Pezoporus*, Först. 1868, which is preoccupied) ; *Agrothereutes*, Först. 1850 (*Gambrus*, Först. 1868, *Spilocryptus*, Thoms. 1873) ; and *Therion*, Curt. 1829–30 (*Exochilum*, Wesm. 1849). *Lampronota*, Curt. 1832, must replace *Meniscus*, Schioedte 1839, as the respective genotypes (*Ichneumon setosus*, Geoffr., and *I. catenator*, Panz.) are congeneric ; *Cylloceria*, Schioedte 1838, is the correct name for *Lampronota*, auct. On similar grounds, *Porizon*, Fall. 1813 (type *I. moderator*, L.) must be used for *Thersilochus*, Hlmgr. 1858, and *Porizonidea*, Vier. 1914, for *Porizon*, auct. *Decatoma*, Spin. 1811, is included in *Eurytoma*, Ill. 1807, on the ground that its genotype (*Chrysis adonidum*, Rossi) is a synonym of *E. aterrima*, Schr. ; *Eudecatoma*, Ashm. 1888, replacing *Decatoma*, auct.

BURNETT (T.). **The Distribution of the Eggs of *Encarsia formosa* Gahan with Respect to its Host, the Greenhouse Whitefly *Trialeurodes vaporariorum* Westwood.**—*Rev. canad. Biol.* **2** no. 4 pp. 378–394, 9 refs. Montreal, 1943. (With a Summary in French.)

The literature on the ability of females of Hymenopterous parasites of insects to avoid oviposition in hosts that have already been parasitised is reviewed [*R.A.E.*, A **26** 102 ; **27** 302 ; **31** 363, etc.], and an account is given of experiments on host selection by *Encarsia formosa*, Gah., an Aphelinid that has been introduced into Canada for the control of *Trialeurodes vaporariorum*, Westw., in greenhouses. It oviposits in the quiescent instars of the Aleurodid, which are generally distributed over the flat surface of the plants and does not appear to be attracted to a host until its antennae come into contact with it. One female was seen to feed on a nymph at a point where it had oviposited, and the author suggests that the fluid on the surface of the host may assist the parasite in determining its suitability.

Observations on the distribution of eggs by females allowed to oviposit in nymphs evenly distributed on graph paper showed that the second, third and fourth instars were parasitised indifferently, though it is usually supposed that the fourth is preferred [*cf.* **15** 240]. Although the amount of superparasitism was considerable, the percentages of nymphs containing 0, 1, 2, 3 and 4 eggs were different from those to be expected from random distribution and the difference was probably significant, indicating that the females tend to avoid nymphs in which eggs have already been laid.

Nymphs on tomato leaves were then exposed to the parasite in two series of experiments in which the numbers of parasites and durations of exposure were such that the parasite should lay about as many eggs as the number of hosts available or 2–3 times as many. In the first series, the actual mean numbers of eggs per host were 0·733–1·08 and their distribution differed considerably from random, but it did not do so in the second, in which the mean numbers were 2·15–3·63.

When nymphs parasitised under natural conditions in a greenhouse were dissected, it was seen that eggs were laid in the second and third instars and in the early stage of the fourth, of hosts already containing eggs, a solitary larva or both. As many as nine eggs were found in a second-instar nymph, and it is thought that the size of the host does not influence selection. In the late or pupal stage of the fourth instar no host containing a larva received an egg, possibly because most of the host tissue had been consumed. The distribution of superparasitism indicated that the ability of the female to avoid parasitised hosts was no greater when they contained small larvae than when they contained eggs. Analysis of two sets of six colonies of nymphs in which the mean numbers of parasites per host were 0·824–1·477 and 0·375–0·782, respectively, showed that avoidance of superparasitism was significant in the first case and insignificant in the second. It was concluded that it is only when the parasitism is distributed about a mean value of one parasite per host that *E. formosa* can to some extent refrain from ovipositing in parasitised hosts.

MARSHALL (J.) & PICKETT (A. D.). **The present Status of the Apple Mealybug, *Phenacoccus aceris* Sig. in British Columbia and Nova Scotia.**—*Canad. Ent.* **76** no. 1 p. 19, 3 refs. Guelph, Ont., 1944.

In making some criticisms of a paper by Rau [*R.A.E.*, A **31** 152], the authors state that the apple mealybug, *Phenacoccus aceris*, Sign., is no longer considered a particularly serious pest in the Kootenay district of British Columbia, since sprays effective for its control there have been found [*cf.* **31** 152–153, 270]. There have, moreover, been few instances of serious damage by it in apple orchards in the Annapolis Valley of Nova Scotia since 1938 ; this is attributed largely to the parasite, *Allotropa utilis*, Mues., which occurs in most infested orchards, and also to the development of a satisfactory spray programme based on Patterson's work [**25** 366].

BALCH (R. E.) & HAWBOLDT (L. S.). **Forest Insect Conditions in Nova Scotia 1943.** —*Rep. Dep. Lds For. N.S. 1943* pp. 47–52, 2 pls., 1 map. Halifax, N.S., 1944.

The disease of the larvae continued to reduce the numbers of *Gilpinia hercyniae*, Htg., on spruce in Nova Scotia in 1943 [*cf.* *R.A.E.*, A **32** 110], though there was some evidence that it was becoming less effective with the reduction of the sawfly population. Of spruce samples examined, 30 per cent. were infested, but all infestations were light except in one small area. Eight colonies of parasites, four of *Exenterus* sp. and four of *Sturmia* sp., were liberated. Die-back of birch associated with infestation by *Agrilus anxius*, Gory, became increasingly serious [see next abstract]. *Pissodes strobi*, Peck, has apparently developed an unusual preference for red spruce [*Picea rubra*] in Cumberland County, where it caused stunted growth in open stands by repeated killing of the leading shoot. Severe infestation by *Coleophora laricella*, Hb., throughout the Maritime region again caused complete browning of foliage on larch. Mortality of the trees is rare, since pupation occurs before the growth of the foliage is completed, but it may follow repeated attacks. Infestation of oak by *Alsophila pometaria*, Harr., was severe in many places, and it also partly defoliated shade trees, particularly elm. An unidentified leaf-rolling larva contributed to the damage on oak, but appeared to be less important. A map is given showing the spread of *Cryptococcus fagi*, Baer., on beech during 1890–1942. Starting in the Halifax peninsula, it has extended over the whole mainland of Nova Scotia, Cape Breton Island, Prince Edward Island, and the southern half of New Brunswick. Overmature spruce was attacked by *Dendroctonus piceaperda*, Hopk.; the best way of preventing outbreaks is the prompt harvesting of mature trees, but they can be checked by felling and sawing or barking all newly-infested trees before the following May. *Saperda calcarata*, Say, was found to be killing small groups of poplars; heavily infested trees should be destroyed and trees of ornamental value protected by painting the egg-scars with creosote in autumn. *Harmologa* (*Archips*) *fumiferana*, Clem., is causing heavy losses of spruce and fir [*Abies*] in Ontario, and though there is as yet no evidence of an outbreak in the Maritime Provinces, frequent sampling of white spruce [*P. glauca*] and balsam fir [*A. balsamea*] is recommended; the latter is particularly subject to attack at maturity and should be promptly harvested. White pine [*Pinus strobus*] was again damaged by *Chermes* (*Pineus*) *pinifoliae*, Fitch; the trees may suffer considerable loss of growth, and young ones may die after three or four years' attack.

Balch (R. E.). **The Dieback of Birch in the Maritime Region.**—*Rep. Dep. Lds For. N.S. 1943* pp. 53–63, 2 maps. Halifax, N.S., 1944.

Surveys of typical stands and reports received from all parts of the Maritime Provinces in 1941–43 show that the die-back of birch associated with infestation by the Buprestid, *Agrilus anxius*, Gory [*R.A.E.*, A **29** 347] is serious in all stands of merchantable size throughout almost the whole of New Brunswick and in some neighbouring parts of Nova Scotia and the Gaspé Peninsula. Most of the stands have at least 25 per cent. of their volume dead or dying, and some in New Brunswick have 90. Symptoms of die-back are common, but less severe, in the north-eastern coastal section of New Brunswick, some other parts of Nova Scotia and Prince Edward Island. The rate of mortality is lowest in trees that are small, either because they are young or because they are suppressed, and greatest in stands that are mature or overmature or that have been cut over within the past 10–15 years [*cf.* next abstract]. Almost all of the hundreds of affected trees examined have shown infestation by *Agrilus*, but this has in some cases not seemed severe enough to explain the amount of die-back present, and uninfested trees in the first stages of die-back have recently been found. No other contributory organism has yet been discovered, but fungi that have been found in a limited number of tops may prove to be of importance. It is evident, however, that the Buprestid is the chief injurious agent associated with die-back, though not the only cause, and that its occurrence in numbers depends on a weakened condition of the trees due to leaf-feeding insects, overmaturity and the exposure that has resulted from severe partial cutting [**29** 348; **30** 466]. Suggestions are therefore made for its control by forest management [**32** 110, 146].

NASH (R. W.). **Damage by the Bronzed Birch Borer in Maine.**—*Bull. Maine For. Serv.* no. 13, 12 pp., 3 figs., 4 refs. Augusta, Me., 1943.

Damage to white and yellow birches (*Betula papyrifera* and *B. lutea*) by *Agrilus anxius*, Gory, has increased considerably in Maine since 1940, when it first became conspicuous [*cf. R.A.E.*, A **29** 347]. To determine the causes of the outbreak, its seriousness and methods of control, observations were carried out in 1941 and 1942 in a number of sample plots established in different districts in stands of various age, density and type. Severe injury occurred east and north of the Kennebec Valley, from 20 to 60 per cent. of the trees having been killed in different sections. Yellow birch was slightly more damaged than white birch. Trees left from past cuttings or thinnings or those that were definitely dominant, especially old ones, were severely injured or killed, but the uncut mature and overmature stands were also heavily infested, especially those on poor or exposed sites. In well-stocked stands of even height and sixty or more years old, the damage was mostly confined to a decrease in size of the top leaves and to killing of the top twigs. Young trees that were damaged and sometimes killed usually stood alone in openings or grew along the edges of stands.

It is suggested that the outbreak of this Buprestid has been due to a general reduction in the vigour of the birches. They have been neglected owing to past lack of market, so that they have become overmature in some stands and dominant in others, and have been exposed by the cutting of other trees and, in the eastern part of the State, by extensive killing of beech due to *Cryptococcus fagi*, Baer., and the fungus, *Nectria* [*coccinea*], associated with it [*cf.* **30** 174, etc.]. In addition, there was a severe drought in 1941, and white birch particularly has been weakened during a number of years by the attacks of various leaf-feeding insects [*cf.* preceding abstract]. Studies showed that the rate of growth of birches had been considerably below the average for at least 15 years.

The percentages of trees infested, severely injured and showing increased injury in the second year were all highest in the dominant class and higher in the co-dominant than in the intermediate class, but the percentage of dead trees was highest in the intermediate class, possibly because the intermediate trees were weaker. Suppressed trees showed no severe injury and no increase in injury in 1942. No definite conclusion could be drawn as to the dependence between the density of the stands and infestation, but lightly stocked stands or scattered trees were generally more severely damaged. It is recommended that the dominant and mature stands should be felled first, that the stands should be clear cut, and that extensive thinning should be avoided.

GRAHAM (S. A.). **Causes of Hemlock Mortality in northern Michigan.**—*Bull. Sch. For. Mich.* no. 10, 63 pp., 19 figs., 14 refs. Ann Arbor, Mich., 1943.

In 1932 and the following years, hemlock [*Tsuga*] suffered abnormal mortality, apparently due to borers, in Wisconsin and Michigan, and in 1938–40, after preliminary examination of several areas in which it was dying, a study of the causes was made in northern Michigan, chiefly in the Ottawa National Forest, in recently logged areas and those that had been disturbed by road construction or other human activities. Hemlock is readily established, but usually becomes predominant only in relatively small tracts where site conditions are especially favourable; fire and unfavourable weather apparently limit the development of vast forests of hemlock in Michigan, and insects tend to reduce its abundance or even to eliminate it where it becomes predominant. *Ellopia fiscellaria*, Gn., destroyed much hemlock in both States for a number of years after 1921 ; extremely dense populations completely defoliated and quickly killed the trees in places where they composed 75 per cent. or more of the upper crown canopy, but the larvae were less numerous and caused little or no injury where the proportion of hemlock was low. After 1925, *Ellopia* practically disappeared, but at about this time, numerous trees were found to be infested with *Melanophila fulvoguttata*, Harr., which had previously been extremely rare.

As detailed examination of recently cut timber in 1938 failed to show positively whether this Buprestid could develop successfully in healthy trees, more detailed investigations, involving a study of its life-history and habits, were carried out. The adults appear in early summer and insert their eggs deeply into bark crevices of suitable trees and logs, either singly or in groups of 2–4. The larvae tunnel to the phloem and, if conditions are favourable, through this to the cambium, where they construct winding galleries between the bark and wood. If conditions are unfavourable, they may continue to tunnel in the phloem, in which case they usually die unless the condition of the tree changes and they can cross the phloem and construct the normal type of gallery. Their apparent inability to penetrate the phloem of some trees suggests that they cannot develop in healthy ones. The larvae pupate in cells in the outer bark, a few in the autumn of the year in which they hatch, but the majority during the following spring or summer. The life-cycle usually lasts one year, but may be extended through a second winter or even longer under specially cool or moist conditions.

The moisture content of logs freshly cut from apparently healthy trees in June 1939 and arranged with their axes running from east to west and raised a few inches above the ground seemed too high for the borer immediately after cutting, but the parts exposed to the sun became sufficiently dry to be infested within a week or two, whereas those not exposed remained unsuitable for a month or more. These results indicate that the moisture content in standing thrifty trees may be too high for infestation. Temperature appeared to affect the larvae much more than moisture ; it sometimes became too high for them to tolerate in the parts of the logs exposed to direct sunlight and remained so low that their rate of development was retarded in other parts. Conditions of exposure resulting in a subcortical temperature range during the day of 60–100°F. or slightly higher appear to be ideal for them, and these conditions occur frequently in standing trees exposed by logging operations. Some of the larvae were attacked by parasites, of which the most common were *Atanycolus* sp., and *Coeloides* sp. The percentages parasitised were almost 50 in parts of the logs exposed to high temperatures and less than 30 on the lower side of the same logs ; in no case, however, were the parasites sufficiently numerous to control the borer.

In the Upper Peninsula of Michigan during 1939–41, the subcortical temperature on the sunny side of exposed trees was not observed to exceed that suitable for the larvae, and it is considered that the condition of the phloem is more important in determining whether a standing tree is suitable for attack. The association of this condition with exposure to direct sunlight was evidenced by the fact that infestation of a tree almost invariably began on the exposed side of the trunk and extended round it in subsequent seasons. It appears, therefore, that exposure of the bole to sunlight may contribute, either directly or indirectly, to hemlock mortality. Experiments to determine whether such exposure results directly in injury to the tree or produces conditions favourable for the borer in a normal tree, in which logs in a particularly favourable condition and a series of uninfested trees in varying states of health and decadence were inoculated with healthy borer larvae, suggested that the attack of living trees is prevented by the moist condition of the healthy phloem and confirmed earlier observations that the larvae cannot complete development in trees that are not extremely decadent. Other possible causes of the death of the trees are discussed, and it is concluded that there is a clear relation between amount and direction of exposure to sunlight and mortality rate, the greatest mortality occurring in trees exposed to the south-west. Recommendations are made regarding the degree to which hemlock trees can safely be exposed during logging.

Concurrent studies of dying hemlock, made in uncut stands in Wisconsin by other workers gave similar results. They found that the root systems of the dying trees attacked by the borer were seriously decadent before the effects were conspicuous in the crowns [*cf. R.A.E.*, A **30** 173], and concluded that severe drought accompanied by secondary attack by *Armillaria mellea* was the probable cause of mortality.

WALTER (J. M.), MAY (C.) & COLLINS (C. W.). **Dutch Elm Disease and its Control.**—*Circ. U.S. Dep. Agric.* no. 677, 12 pp., 12 figs. Washington, D.C., 1943.

This circular is primarily designed for those concerned in the maintenance of elms that provide concealment for factories and other structures at present of military importance in the north-eastern part of the United States. It contains a survey of data, obtained in the United States and Europe, on the symptoms of Dutch elm disease caused by *Ceratostomella ulmi*, the susceptibility or resistance to it of important species and varieties of elm, the biology of the fungus and the Scolytids that transmit it, of which the species of importance in the United States are *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and recommendations for control. Control is best effected by preventing the emergence of the bark-beetles from infected elm trees or elm wood lying on the ground, and particularly the emergence of adults of the overwintered brood, which appear in May or June and account for the most damaging inoculations. It is therefore important to bark or burn infested wood before May or treat it with a spray of 3 parts orthodichlorbenzene or 1 part monochlornaphthalene in 12 parts fuel oil (26–28° Bé.) [*cf. R.A.E.*, A **30** 181 ; **31** 92]. These sprays should be applied in the interval between the breaking of leaf-buds and the formation of 3-inch shoots on American elm [*Ulmus americana*], as they are not effective at temperatures below 50°F. or when the insects are not developing activity. They can also be used between May and September as repellents on freshly felled uninfested wood. Wood in contact with the soil is the most effective source of inoculum since it maintains a moisture content favourable to sporulation of the fungus. Pruning wood infested by the beetle is advisable at all times of the year ; it does not normally remove all wood invaded by the fungus, but observations have shown that many elms, even of susceptible species, outgrow the effects of the disease in a few years, provided that they are not re-inoculated.

BARBER (G. W.). **Husk Development of Sweet Corn as affected by Moisture Supply, an important Factor in Corn Earworm Control.**—*J. agric. Res.* **68** no. 2 pp. 73–77, 1 fig. Washington, D.C., 1944.

Differences in the effectiveness of injecting mineral oil containing insecticides into the ears of sweet maize for the control of *Heliothis armigera*, Hb., have been observed in different fields planted from the same lot of seed at different times of the year. As the effectiveness of this treatment, which is directly against larvae in the silk lying between the tip of the husk and the tip of the cob [*cf. R.A.E.*, A **31** 274], is known to depend on characters of the husk, including its extension beyond the tip of the cob, husk measurements at the time of roasting-ear harvest were compared in fields planted in New Jersey on different dates. In 1939, the average husk length of ears in a field that was subjected to severe drought was only 44 per cent. of that in two other fields of the same variety that were grown during a period of approximately normal rainfall, and in 1940, six fields of another variety showed husk lengths varying from 9 to 117 per cent. of the normal, apparently owing to variations in rainfall during the periods of development. Drought also makes the husks limp so that they do not press tightly against the kernels and thus increases the effect of shortness in enabling the larvae to move more quickly to parts of the ear where the insecticide does not reach them.

It is therefore concluded that drought may reduce the effectiveness of the treatment in varieties of sweet maize with husk characters that are normally favourable for it, and that it has probably been largely responsible for the differences that have been observed in the effectiveness of this method of control.

Pepper (J. H.) & Hastings (E.). **Biochemical Studies on the Sugar Beet Webworm** (*Loxostege sticticalis* **L.**) **with special Reference to the Fatty Acids and their Relation to Diapause and Sterility.**—*Tech. Bull. Mont. agric. Exp. Sta.* no. 413, 36 pp., 62 refs. Bozeman, Mont., 1943.

Loxostege sticticalis, L., is very injurious to beet in the United States when it occurs in outbreak numbers, but the abundance of larvae in any year or generation is dependent on the degree of fertility of the moths and the proportion of larvae from previous generations that enter into diapause, both of which vary greatly [*cf.* *R.A.E.*, A **30** 461, 462]. Dissection and microscopic examination of some thousands of individuals in various stages during the last nine years at the Montana Experiment Station showed that the fat-bodies differed considerably in individuals from different localities or from the same locality in different years or generations ; constant differences were observed in type of fat between sterile and fertile females, and between developing and diapausing fifth-instar larvae. These observations, together with the fact that the chemicals that are successful in breaking dormancy [**25** 556] fall into the general group of fat solvents, suggest that the biochemical and physiological reactions of the fat-body may be connected with both dormancy and sterility.

Investigations on the chemistry of the fats involved were therefore carried out, and the results are given in this paper. A general analysis of the whole insect for moisture, fat, protein, chitin and ash showed considerable variations in both moisture and fat content at various stages of development. A gradual change took place in the composition of the fatty acids during development from the fifth instar to the adult stage. No chemical differences were found that could account for the observed differences in fat body between developing and diapausing larvae, but the unsaturated fatty acid content of the fatty material appeared to have a direct connection with sterility. No data are available to show which of the fatty acids are essential for egg development or which of them the insect is capable of synthesising, but the linoleic-acid content decreased from 26·1 per cent. of the unsaturated fatty acids in fifth-instar larvae to 0·8 per cent. in females in which egg development was almost complete and no linoleic acid was found in sterile females, indicating that this acid is essential for normal development and reproduction, and that it cannot be synthesised in amounts sufficient for normal metabolic activities. A gradual increase in linolenic acid throughout the later stages of development, however, suggests that this may be used to a greater extent as the linoleic acid is being depleted. In females showing no sign of egg development, no acids with greater unsaturation than one double bond were found. The data also indicate that oleic acid is present, but less important than the other two acids.

The only direct source of any of the fatty acids must be the material ingested by the larvae, since adults feed only on nectar and water [*cf.* **26** 474]. The omnivorous habits of the larvae subject them to a wide variety of feeding conditions and might result in a variable linoleic acid reserve, which could bring about the sporadic and regional occurrence of sterility ; the stage of development of the plants may also influence the linoleic acid reserve in the insect. Analysis of two of the preferred food-plants, *Chenopodium album* and sugar-beet, and of *Artemisia* sp., on which the life-cycle can be completed, showed that the first contained the greatest proportion of linoleic acid ; the other two plants contained a high percentage of unsaturated acids, but chiefly linolenic acid [*cf.* **25** 310]. Earlier investigations at the same station showed that at least three successive generations of fertile females could be obtained from larvae fed exclusively on *C. album*, and observations on outbreaks indicated that these result from an increase in population on food-plants other than sugar-beet.

BISSELL (T. L.). **Life History of** *Pseudoclista globosa* **Tns., Parasite of the Cowpea Curculio.**—*Georgia Ent.* **1** no. 1 pp. 8–9. [Atlanta, Ga.] 1942. [Recd. 1944.]

Observations on the life-history of *Myiophasia* (*Pseudoclista*) *globosa*, Tns., an important parasite of the larvae of *Chalcodermus aeneus*, Boh., on cowpeas in Georgia [*cf. R.A.E.*, A **32** 191] were begun in 1940 when young larvae of the Tachinid were found crawling in the green pods. One placed on a larva of *C. aeneus* burrowed into it in a few minutes. The parasite feeds internally until the host leaves the plant to pupate in the soil. It then attaches itself in the mesothorax, punctures the skin and extrudes its posterior spiracles to obtain air. It pupates within the skin of the host, and the adult emerges through the soil. Eggs were not observed, but the life-cycle from egg to adult probably lasts about 30 days.

FLOYD (E. H.), BECNEL (I. J.) & HADDON (C. B.). **Experiments for the Control of the Cotton Aphid.**—*Bienn. Rep. N.E. La Exp. Sta. 1941–42* pp. 27–30. St. Joseph, La. [1943.]

The results of experiments carried out in Louisiana in 1941 and 1942 to determine the effectiveness of adding aphicides to dusts of calcium arsenate applied against the boll weevil [*Anthonomus grandis*, Boh.] on cotton in order to prevent the increase in infestation by the cotton Aphid [*Aphis gossypii*, Glov.] that follows its use are given in tables and discussed. A fuller account of the work in 1941 has already been noticed [*R.A.E.*, A **31** 237]. Nicotine was the only aphicide tested in 1942, but a " fixed " form of it (Black Leaf 155) was used as well as Black Leaf 10 and proved equally effective. Mixtures of either with calcium arsenate reduced the numbers of Aphids very considerably below those on untreated plants, which were only half as severely infested as plants treated with calcium arsenate alone. Black Leaf 155 is easy to mix with calcium arsenate and can be applied in the morning or afternoon, whereas other forms of nicotine are not effective unless applied in the afternoon or when the plants are dry. Moreover, it shows no appreciable loss of nicotine content when stored with calcium arsenate in an open container ; this advantage is due to the fact that moisture is required to release the nicotine from it.

Infestation by the weevil was light and late in 1942, and calcium arsenate was first applied much later than in 1941. As a result, although the average Aphid populations were similar in the two seasons, they did not increase to injurious numbers in 1942 until all the bolls had set and so caused much less damage than they do when early applications of calcium arsenate cause them to increase during an earlier period in the development of the plants. The yields of seed cotton per acre were 2,835 lb. for calcium arsenate alone, 2,970 lb. for no treatment, 3,002 and 3,019 lb. for calcium arsenate with 1 per cent. nicotine from Black Leaf 155 and Black Leaf 10, respectively, 3,035 lb. for calcium arsenate with 2 per cent. nicotine from Black Leaf 10 in alternate applications, and 3,062 lb. for a dust containing 1 per cent. nicotine from Black Leaf 10 and no calcium arsenate.

EVANS (A. C.). **Value of the *p*F Scale of Soil Moisture for expressing the Soil Moisture Relations of Wireworms.**—*Nature* **152** no. 3844 pp. 21–22, 4 refs. London, 1943.

The cuticle of wireworms is known to be freely permeable to water and to arsenite ions [*cf.* *R.A.E.*, A **22** 248; **27** 28], and experiments at Rothamsted with wireworms immersed in solutions of sucrose after being anaesthetised to prevent drinking and excretion also showed that each behave as an osmotic system bounded by a semi-permeable membrane. It was calculated from the data obtained that a solution in which they would show no change in weight has a vapour pressure depression of 0·6 per cent.

When normal wireworms were kept in rich loam soil with different moisture contents, those in soil in which the vapour pressure depression was less than 0·6 per cent. showed no consistent change in weight, the loss of water in excretion being balanced by the intake of water through the cuticle; in soil in which the depression exceeded 0·6 per cent., water was lost, chiefly through the cuticle, there being little or no excretion. In dry soils, the vapour pressure depression is due chiefly to the " suction " of the soil moisture, that is, to the fact that the water retained in the soil pores has a pressure less than that of atmospheric pressure. A suction of eight atmospheres is required to produce a depression of 0·6 per cent. This has a pF value of 3·9 in the scale proposed by R. K. Schofield, in which pF represents the logarithm of the height in centimetres of a column of water corresponding to the suction. Further experiments with other soils showed that the rate of loss of water by wireworms is fairly constant in soils with the same pF value, regardless of moisture content, and that the scale can therefore be used to express the humidity of soils in relation to loss of water by wireworms.

RIPPER (W. E.). **Biological Control as a Supplement to chemical Control of Insect Pests.**—*Nature* **153** no. 3885 pp. 448–452, 2 figs., 20 refs. London, 1944.

The author points out that races of certain insects showing increased resistance to insecticides [*cf.* *R.A.E.*, A **32** 115, etc.] have developed as a result of the survival of resistant individuals, and that the production of such races and the need for repeated treatments could both be avoided by the use of an insecticide that had little effect on the parasites and predators of the pest concerned, so that they would be abundant enough to eliminate the relatively small numbers of the latter that survived a single application. Nicotine vapour has recently been extensively and successfully used for the control of various Aphids on farm and market garden crops in Great Britain, and it can be shown that a concentration of 0·8 mg. per litre kills 80–99 per cent. of certain Aphids in 40–60 secs. at 60–80°F., without seriously affecting Coccinellids, Syrphids or Braconid endoparasites.

A quantitative study of changes in the populations of *Brevicoryne brassicae*, L., and its predators and parasites caused by the selective action of nicotine was therefore carried out. A field of brussels sprouts with an infestation of 98 million Aphids per acre, in which the only natural enemies were *Aphidius brassicae*, Marsh., and Syrphid larvae, was fumigated on 28th July, at a temperature of 78°F., with $3\frac{1}{4}$ lb. nicotine (95 per cent. pure) per acre, applied from a machine provided with a gas-proof apron and moving at 1 mile per hour, so that the insects were exposed to the fumes for one minute. Population counts on 31st July showed a reduction of 99·9 per cent. in the numbers of Aphids, a marked increase in the percentage of Aphids parasitised, and only a slight reduction in the numbers of Syrphid larvae. Parasitised Aphids from the field and from a similar one that was not treated were collected, and 100 per cent. parasite emergence was obtained in both cases. The Aphid population in the treated field showed some increase between 31st July and 3rd August, probably owing to immigration, but was again 0·1 per cent. of the initial population on 13th August. On 18th August, no living Aphids were found, all the survivors having been killed by parasites or predators. There were a few parasitised Aphids, but no Syrphid larvae, as the Syrphid adults had not been induced to oviposit by the small number of Aphids left after fumigation. Aphids reappeared a week later and, owing to the scarcity of natural enemies, reached injurious numbers after three weeks. In the untreated field, the Aphid population remained almost stationary through the summer and decreased to about half its former size towards mid-September, and the populations of parasites and Syrphid larvae remained fairly constant for four weeks, after which the proportion of parasitised Aphids increased as usual. Treatment with a selective insecticide should not be carried out before the beneficial insects are established, and should be repeated if necessary or deferred to a date that would ensure that the parasites can control the newly arriving migrants. In practice it is usual to fumigate in the middle of August or September.

Oliver (F. W.). **A Mass Catch of Cabbage Whites by Sundews.**—*Proc. R. ent. Soc. Lond.* (A) **19** pt. 1–3 p. 5. London, 1944.

The author gives an account of the capture of adults of *Pieris rapae*, L., by *Drosera anglica*, observed in the Norfolk Broads on 4th August 1911. The plants covered an island some two acres in extent, and 4–7 butterflies were adhering to each. The average number of butterflies per square foot, based on several counts, was 70, and it was estimated that some six million were being destroyed. In many cases, parts of the bodies had already been dissolved by the digestive fluid of the plants ; if the butterflies were trapped shortly after daybreak, they had been there no longer than nine hours. None was seen to escape.

Page (A. B. P.) & Lubatti (O. F.). **Application of Fumigants to Ships and Warehouses. IV. A Vaporiser for Ethylene Oxide.**—*J. Soc. chem. Ind.* **54** no. 30 pp. 246T–250T, 4 figs. London, 1935. [Recd. 1944.]

Brown (W. B.). **V. Distribution of Ethylene Oxide in Barges containing dried Fruit.**—*Op. cit.* **56** pp. 116T–122T, 6 figs. 1937. [Recd. 1944.]

Fumigation with ethylene oxide can be carried out efficiently by spraying it as a liquid at temperatures above about 15°C. [59°F.], but below this some provision should be made for supplying the whole of the latent heat of vaporisation. In the fourth part of this series [*cf.* *R.A.E.*, A **22** 2], the authors describe a vaporiser used for the fumigation of dried fruits in barges with this compound and explain the factors taken into consideration in its design ; the method of operation is discussed and the results of tests with it are given.

The fifth part is an account of the fumigation of dried fruit on arrival in London in the steel barges used to transport it from ship to warehouse, most of which have a capacity of 5,000–7,500 cu. ft. The arrangement of the boxes of fruit, the covering of the hatch openings and the method of application of the fumigant are described. At temperatures above 50°F., ethylene oxide containing 10 per cent. carbon dioxide is ejected as a fine spray towards both ends of the barge from nozzles at the ends of a T-piece with branches 15 inches long in an open space in the centre. At temperatures below 50°, the fumigant is heated by means of a vaporiser, such as the one described in the previous part, before being introduced by means of a similarly situated T-piece with branches 5 ft. long.

Laboratory experiments to determine the toxicity of ethylene oxide to all stages of *Ephestia elutella*, Hb., *E. cautella*, Wlk., and *Plodia interpunctella*, Hb., and its penetration into boxes of dried fruit indicated that, 15 minutes after the end of vaporisation, the minimum concentration in the free space of the barge should be 60 mg. per litre to give reasonable certainty of complete kill. The dose of fumigant for the barges was calculated on a basis of 1 lb. for every 50 boxes of fruit (approximately 1¼ tons) and 6½ lb. per 1,000 cu. ft. of free space [*cf.* **32** 311]; it was assumed that the fumigant contains 85 per cent. ethylene oxide. The fumigation usually lasted 18 hours. The routine testing of barge fumigation by an aspirator method, which is described, showed that the penetration into all the boxes, with the possible exception of those on top of the tiers, was satisfactory, but that the concentration diminished rapidly in the free space above the boxes and was below the safe lethal dosage at some points within one or two inches of the hatch covers, so that larvae that crawled on to the covers might have survived. fumigation. The low concentrations near the hatch covers may be due to loss of fumigant by draughts or by diffusion through faults in the sealing of the barge, diffusion through the tarpaulins, movements of air or the settling of the vapour, which is heavier than air, in the lower part of the barge, from which diffusion upwards is slow. Uneven distribution of the fumigant between the two ends of the barge was sometimes recorded, possibly caused by disarrangement of the outlets, partial stoppage of one of them, faulty sealing of the barge or uneven stacking of the fruit.

Laboratory tests showed that the loss of fumigant by diffusion through the tarpaulin was insignificant, the most important factors affecting distribution being the density of the ethylene-oxide vapour, which tends to settle initially in the lower part of the chamber. The fact that the density of the gas has more effect than the rate of diffusion on the speed with which even distribution is attained is illustrated by comparison with the results obtained in similar experiments with hydrocyanic acid gas.

The author points out that improved distribution of the fumigant is to be expected in the upper parts of the barge if it is introduced near to the hatch covers and that general distribution should be still further improved if it is introduced at a number of points throughout the length of the barge, and gives the results of two experiments in which barges evenly laden with fruit to deck level were fumigated with vaporised ethylene oxide directed upwards and outwards from six pairs of holes bored at equal distances along the branches of a T-piece, which extended to within about 4 ft. of each end of the barge; these showed a marked improvement over previous tests in the general distribution of the gas.

BLEWETT (M.) & FRAENKEL (G.). **Intracellular Symbiosis and Vitamin Requirements of two Insects,** *Lasioderma serricorne* **and** *Sitodrepa panicea*.—*Proc. roy. Soc.* (B) **132** no. 867 pp. 212–221, 4 graphs, 13 refs. London, 1944.

The following is taken from the authors' summary of experiments showing that the intracellular symbionts of larvae of *Lasioderma serricorne*, F., and *Sitodrepa panicea*, L., supply vitamins of the B group [*cf. R.A.E.*, A **32** 186]. On white flour, a food deficient in such vitamins, normal larvae grow very much better than larvae freed from symbionts, while no such difference in the growth rate occurs on a diet rich in them, such as wholemeal flour plus yeast. On an artificial diet that contains the vitamins in pure substances, the normal *Lasioderma* larva grows well or fairly well in the absence of either thiamin, riboflavin, nicotinic acid, pyridoxin or pantothenic acid, and the normal *Sitodrepa* larva in the absence of any of these vitamins except thiamin. The sterilised larvae of both species fail to grow in the absence of any of these five vitamins.

SMITH (J. H.) & FORBES (A. C.). **How to defeat Wood-borers.**—*N.Z. J. Agric.* **68** no. 2 pp. 83, 85–88, 8 figs. Wellington, N.Z., 1944.

The principal insects that damage wood in buildings in New Zealand are *Anobium punctatum*, Deg. (*domesticum*, Geoffr.), *Lyctus* spp., the native Cerambycid, *Ambeodontus tristis*, F., the native dry-wood termite, *Kalotermes brouni*, Frogg., and the earth-dwelling termites, *Coptotermes acinaciformis*, Frogg., *C. lacteus*, Frogg., and *C. frenchi*, Hill, which have been introduced from Australia [*cf. R.A.E.*, A **32** 29, etc.].

The adults of *Anobium* and *Lyctus* emerge from December to March in Wellington, somewhat earlier in the north and later in the south, from flight-holes 1·6 mm. or less in diameter, while those of *Ambeodontus* emerge chiefly during April–June and leave oval holes over 5 mm. across the major axis, usually on the under surface of timber. The life-cycles of these beetles occupy one to three, one, and three or more years, respectively. The adults are briefly described. *Anobium* chiefly attacks the sapwood in softwoods [*cf.* **30** 271] and oviposits in old flight-holes, crevices and joints ; the larvae mine in all directions leaving a loose, coarse and gritty frass, which may be discharged from cracks or from old flight-holes. *Lyctus* attacks exclusively the sapwood of hardwoods, laying eggs in the cavities of exposed pores ; hatching occurs after a few weeks. *Ambeodontus* attacks both sapwood and heartwood, mainly of softwoods, and deposits eggs in cracks, crevices and joints, under projections or on the surface of roughly sawn timber. The larvae of *Lyctus* and *Ambeodontus* tend to mine along the grain of the wood ; frass from the former is densely packed and flour-like and is often forced out from pores, cracks or old flight-holes, while the latter leave tunnels faintly marked by gnawing and packed with undigested wood-dust. The pupal chambers of *Anobium* and *Lyctus* lie close beneath the surface of the wood. Termites at times construct extensive burrows in timber, leaving an abundance of faecal pellets. The three species of *Coptotermes* are now established and do considerable damage to floor joists, flooring, weatherboarding and studs in a few localities.

Control of all boring insects depends largely on early detection of infestation, and all wood of every type on a property should be frequently inspected. Search for new flight-holes should begin in October in the north and in December in the south. In the interior of buildings, flight-holes of the last season will retain a fresh appearance, quickly lost through weathering in wood on the exterior. The application of creosote is recommended for all wood where the smell will not be objectionable [**30** 271]. For surfaces to be painted, house interiors and furniture, a solution of 5 per cent. pentachlorphenol, 94 per cent. light diesel oil or kerosene and 1 per cent. pine oil is effective [*cf.* **29** 448]. Benzene or orthodichlorbenzene may be substituted for pine oil, but concentrations of up to 3 per cent. are sometimes necessary ; on the other hand, no additional solvent may be required if the solvent power of the light oil selected is high enough. The pentachlorphenol should be soaked for 24 hours or more in a solution containing all the additional solvent and a small quantity of the light oil, before dilution with the remainder ; prolonged stirring is usually necessary, but heating involves risk of fire. Water solutions of toxic salts, such as zinc chloride, are only suitable for timber before it is put into use, owing to the swelling and shrinking that accompanies changes in the moisture content of the wood. The need for permanence in a preservative is obvious ; volatile materials, such as paradichlorbenzene, orthodichlorbenzene and cresylic acid will eradicate borers but do not prevent re-infestation. Whatever the preservative, wood that cannot be immersed in it should be treated with the highest possible degree of thoroughness by brush or spray ; the solution should be allowed to soak into the wood and fill cracks and joints, and it is best to apply a second coat after the first has dried or soaked in. A hand pressure pump, or, when available, power-driven compressors and injector guns are recommended for forcing the solution into flight-holes. In the laboratory, termites have penetrated thinly impregnated wood, leaving heavily treated areas untouched, and it is thought that other borers may do so. Damage by *Ambeodontus tristis* may extend for several feet beyond the flight-holes, and exploratory boring in contiguous timber is recommended to ascertain its extent. Heavily infested flooring should be removed and the joists should be thoroughly treated if the infestation has spread to them; where their strength permits, auger holes should be bored and preservative injected into them so that it may seep along the grain to form a barrier against the spread of infestation.

Harris (W. V.). **Collected Recipes for Insecticides.**—*E. Afr. agric. J.* **9** no. 3 pp. 163–165. Nairobi, 1944.

Twenty-two formulae are given for baits, bait-sprays, sprays and dusts, with very brief notes on the fumigation of grain with carbon bisulphide and of small quantities of seeds or clothing with petrol [*cf. R.A.E.*, A **31** 183] followed by a list of popular names of species or groups of insect pests common in Tanganyika Territory, showing the formulae suitable for use against each.

Posnette (A. F.). **The Diagnosis of Swollen-shoot Disease of Cacao.**—*Trop. Agriculture* **21** no. 3 pp. 56–58, 4 refs. Trinidad, 1944.

A collective description is given of the symptoms of the swollen-shoot disease of cacao in the Gold Coast, as caused by different strains of the virus. Vein clearing appears to underly all leaf chlorosis symptoms of the strains studied; this resembles the result of insect punctures in the early stages, and develops into a mottle and finally to a yellow mosaic pattern that varies according to the virus strain and to the interval between infection and the development of the leaf. The virus frequently causes crinkle, twisting, raggedness or a shot-hole effect resembling insect damage, and commonly results in a decrease in the size of the leaves and their shedding, sometimes soon after the bud opens. Characteristics are described by which swollen-shoot mosaic may be distinguished from the mottle caused by a soil condition apparently due to the presence of excess phosphate in alkaline solution. The most virulent form of the disease causes the development of dwarfed and rounded pods; and mottling of unripe pods, which may be confused with thrips damage or with skin irregularities due to uneven growth, has recently been confirmed as a symptom. The virus may cause swelling of the stems, short internodes similar to those due to heavy Psyllid infestation, delayed flushing and die-back. Swellings are the only known symptoms shown by the roots, and no abnormalities have been found in the flowers of infected trees.

The relative importance of the different symptoms in the diagnosis of the disease is discussed; in a typical case, either the swellings or the mosaic are distinctive, but where damage by Capsids of the genus *Sahlbergella* [*cf. R.A.E.*, A **32** 287] is severe, only dead leaves may be present and the swellings may be so scarred that they might be the result of external injury, and under these conditions diagnosis is almost impossible. In most outbreaks affecting more than ten trees, diagnostic symptoms can be found in at least one tree. Infected trees make such poor recovery after Capsid attack, that they are often first noticed as being more severely damaged by *Sahlbergella* than the surrounding cacao.

Moutia (A.). **Division of Entomology.**—*Rep. Dep. Agric. Mauritius 1942* pp. 12–16. Port Louis, 1943.

Surveys in Mauritius in 1942 and the preceding years have shown that infestation of sugar-cane by *Clemora* (*Phytalus*) *smithi*, Arr., continues to spread at the periphery of the centres originally infested, but that severe infestation seldom recurs on an estate from which it has been eliminated. Where renewed infestation does occur, it is usually associated with a combination of high rainfall and high temperature. The Scoliid, *Campsomeris phalerata*, Sauss. [*cf*. *R.A.E.*, A **31** 160] was abundant locally in 1942, where food-plants for the adults [*cf*. **28** 587] had been planted in the cane fields, but did not prevent severe infestation. *Trichogramma australicum*, Gir., was reared on eggs of *Corcyra* [*cephalonica*, Staint.] and liberated against *Proceras sacchariphagus*, Bojer, in three localities [*cf*. **31** 161], but the results obtained were inconsistent; *Xanthopimpla stemmator*, F., remained scarce.

Trypetids collected comprised *Dacus* (*Strumeta*) *zonatus*, Saund., from fruits of *Terminalia catappa*, *D*. (*S*.) *cucurbitae*, Coq., *D. ciliatus*, Lw., and *D. d'emmerezi*, Bez., from cucurbits, *Ceratitis capitata*, Wied., from peaches and *C. catoiri*, Guér., from various fruits; *D. d'emmerezi* and *C. catoiri* are indigenous. In some localities maize seedlings were damaged by *Crambus malacellus*, Dup. [*cf*. **32** 161], cutworms and the ant, *Solenopsis geminata*, F.

TREHAN (K. N.) & BAGAL (S. R.). **Life-history and Bionomics of Potato Tuber Moth** (*Phthorimaea operculella* **Zell., Lepidoptera: Gelechiidae**).—*Proc. Indian Acad. Sci.* Sect. B **19** no. 5 pp. 176–187, 4 figs., 10 refs. Bangalore, 1944.

Descriptions are given of all stages of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., with records of the periods required for their development in stored potatoes under summer and monsoon conditions and of the durations of adult life and numbers of eggs laid when the moths were or were not given water or sugar solution. In tests of the toxicity of various vapours, naphthalene gave much the most promising results; it killed eggs, larvae and adults, treatment of the pupae reduced the numbers of adults that emerged and the numbers of eggs they laid, and treatment of infested potatoes prevented the further progress of infestation.

ISAAC (P. V.) & RAO (K. V.). **A Key for the Identification of the Larvae of the known Lepidopterous Borers of Sugarcane in India based on morphological Characters.**—*Indian J. agric. Sci.* **11** pt. 5 pp. 795–803, 5 pls., 10 refs. Delhi, 1941. [Recd. 1944.]

ISAAC (P. V.) & VENKATRAMAN (T. V.). **A Key for the Identification of the Pupae of the known Lepidopterous Borers of Sugarcane in India, based on morphological Characters.**—*T.c.* pp. 804–815, 5 pls., 11 refs.

In addition to the keys, these two papers contain descriptions of the external morphology of the full-grown larvae and pupae, respectively. The species dealt with comprise *Scirpophaga nivella*, F., *Argyria tumidicostalis*, Hmps., *Proceras* (*A*.) *sticticraspis*, Hmps., *P*. (*Diatraea*) *auricilius*, Dudgn., *P*. (*D*.) *venosatus*, Wlk., *Chilo zonellus*, Swinh., *C. trypetes*, Bisset, *Raphimetopus ablutella*, Zell., *Emmalocera depressella*, Swinh., *Sesamia inferens*, Wlk., *S. uniformis*, Dudgn., and *Procometis trochala*, Meyr.

RAHMAN (K. A.) & ATIQUR RAHMAN ANSARI. **Scale Insects of the Punjab and North-West Frontier Province usually mistaken for San José Scale** (**with Descriptions of two new Species**).—*Indian J. agric. Sci.* **11** pt. 5 pp. 816–830, 3 pls., 11 refs. Delhi, 1941. [Recd. 1944.]

Descriptions are given of *Quadraspidiotus* (*Aspidiotus*) *perniciosus*, Comst., and nine other Coccids that resemble it in morphology or in symptoms of infestation, with lists of the food-plants on which they were found during a recent survey [*R.A.E.*, A **32** 290] and a key to them. They include two new species, *Aonidia zizyphi* on *Zizyphus jujuba*, and *Lapazia peshawarensis* on plum and peach, both from the North-West Frontier Province.

JURADO (A. J. R.). **La sílice en la conservación de los cereales.** [Silica for the Conservation of Cereals.]—*Rev. argent. Agron.* **9** no. 1 pp. 1–18, 2 pls., 1 graph, 22 refs. Buenos Aires, 1942. [Recd. 1944.]

Preliminary small-scale experiments with ground anhydrous crystalline silica for the control of *Calandra* (*Sitophilus*) *granaria*, L., and *C.* (*S.*) *oryzae*, L., in wheat having given promising results, two series of tests were carried out with larger quantities of grain infested with weevils and *Sitotroga cerealella*, Ol. [*cf. R.A.E.*, A **30** 30]. In the first, wheat grown in 1937–38 and maize grown in that year and the next were mixed with the dust at the rate of 1, 2 or 3 lb. per 100 lb. grain in January 1940, put in sacks and examined for infestation at the time of treatment and at intervals until February 1941. In the second, maize was stored on the cob in a primitive type of silo or shelled and sacked in September 1940, and the silica dust was used at rates of 8 oz. or 1 lb. per 100 lb., with or without the addition of 8 oz. talc to improve adhesion. The dust was put in the silos as they were being filled or mixed with the shelled maize before it was sacked. The cobs were removed from the silos and examined in February 1941, and samples of the shelled maize were examined at intervals until March 1941. In the first series, there was no significant difference between treatments, and the percentage of grains punctured increased at first and then remained constant in all the samples, indicating that the dust does not prevent the development of eggs or weevil larvae already present. In the second, the addition of talc was found to be unnecessary. The reduction in infestation was less in the silos than in the sacks, possibly because of lack of uniformity in the distribution of the dust, the small exposed surface of the grain on the cob and the fact that the silos were smaller than usual, and had therefore a relatively larger surface area and permitted the penetration of humidity more readily. Infestation was heaviest at the top in treated silos, but at the bottom in untreated ones, indicating that the dust accumulates at the bottom. The addition of 1 lb. silica per 100 lb. was more effective than the addition of 8 oz. in most of the varieties of maize tested in sacks, but there was no significant difference in the case of sweet maize.

The addition of the dust did not reduce the germination of the grain or affect animals fed on it.

CHIARELLI (A.). **Un geométrido perjudicial a la yerba mate,** *Thyrinteina arnobia.* [A Geometrid that injures Maté.]—*Rev. argent. Agron.* **10** no. 3 pp. 250–255, 2 pls., 1 fig. Buenos Aires, 1943.

Since 1940, *Thyrinteina arnobia*, Stoll, has caused increasing though sporadic damage to maté [*Ilex paraguensis*] in the north-east of Argentina. Notes are given on the synonymy and distribution of this Geometrid, and all stages are described. It was reared in the laboratory, where the larvae refused the leaves of several plants, including *Citrus* and *Acacia*, and were fed on leaves of *Villaresia congonha*, which they rapidly skeletonised. The eggs were laid in masses of 165 or more, and the egg, larval and pupal stages lasted 2, 35, and 7 days, respectively, at about 20–22°C. [68–71·6°F.].

OGLOBLIN (A.) & JAUCH (C.). **Reacciones patológicas de los acridios atacados por** *Aspergillus parasiticus.* [Pathological Reactions of Acridids attacked by *Aspergillus parasiticus.*]—*Rev. argent. Agron.* **10** no. 3 pp. 256–267, 4 pls., 2 figs., 16 refs. Buenos Aires, 1943.

Schistocerca cancellata, Serv., *Trigonophymus* (*Dichroplus*) *elongatus*, Giglio-Tos, and, particularly, *T.* (*D.*) *arrogans*, Stål, bred in the insectarium at José C. Paz, Argentina, were frequently attacked, with fatal results, by the fungus, *Aspergillus parasiticus*. First symptoms of the infection always appear in the vicinity of the thoracic spiracles. In some cases, the infection is restricted, and the insect continues to live while the fungus reaches the reproductive stage inside the thoracic air-sacs. Infected insects often show a dark spot on the ventral surface of the thorax due to the necrosis of the tissue caused by the fungus. The fungus can also develop as a saprophyte ; it was found in nature on excreta of Acridids and on dead eggs of *Epicauta*. Stages in its parasitic and saprophytic development are described, and its action on the host's tissues discussed. Artificial infection was most successful when the spores were introduced into the thoracic spiracles, but external contact with them was sufficient if the air humidity was near saturation point. They begin to germinate in 20 hours at 26°C. [78·8°F.] and in 8½ hours at 29°C. [84·2°F.]. The first deaths occur in 3–5 days. Defensive reactions of hosts consist in cleansing movements ; in moulting during which spores adhering to the skin are shed with the latter ; and in phagocytosis by leucocytes.

Griot (M.). **Oruga que vacía las cápsulas del lino.** [A Caterpillar that eats out the Capsules of Flax.]—*Rev. argent. Agron.* **11** no. 1 pp. 44–57, 2 pls., 5 figs., 2 graphs, 6 refs. Buenos Aires, 1944.

In the province of Santa Fe, Argentina, flax is attacked by larvae of the Noctuids, *Plusia* (*Rachiplusia*) *nu*, Gn., *Thyreion gelotopoeon*, Dyar, and *Protoleucania* (*Neleucania*) *albilinea*, Hb., which feed on the leaves until the capsules form and then bore into these, usually at the base, and devour their contents. The degree of injury varies considerably from year to year and is most severe in plants that are cut latest and in those grown in the richest soils because they are exposed to infestation for the longest time.

An account is given of investigations on the bionomics of *Plusia nu*, which is the most injurious species, together with descriptions of all stages, a brief review of its distribution in South America and a list of its food-plants. It is sometimes a pest of lucerne, which serves as an alternative food-plant during summer and winter, until the flax is suitable for attack in spring. In the insectary, females oviposited for up to a week, beginning on the day of emergence, and died within 10 days. They laid 34–261 eggs in 3–7 days on the leaves of flax or lucerne and sometimes on the stems. The incubation period varied from 2 days at 25·5 and 27·7°C. [77·9 and 81·86°F.] to 15 days at 12·7°C. [54·86°F.], and the time from hatching to emergence from 19 days at an average of 26·4°C. [79·52°F.] to 63 days at 16·8°C. [62·24°F.]. Larvae are found throughout the year, but are less abundant in winter, when the adults, which fly throughout the day at other seasons, are rarely seen. There appear to be at least five generations in the year. An unidentified bacterial disease caused heavy mortality of larvae of *P. nu* and *Colias lesbia*, F., on lucerne in February and March, and was observed in *P. nu*, *T. gelotopoeon* and *Protoleucania albilinea* on flax. *Plusia nu* was also attacked by entomogenous fungi and by several Dipterous and Hymenopterous parasites, a list of which is given.

Blanchard (E. E.). **Tres ácaros dañinos para los cultivos argentinos.** [Three Mites injurious to Argentine Crops.]—*Rev. Fac. Agron. La Plata* (3) **24** (1939) pp. 11–18, 3 figs. La Plata, 1940. [Recd. 1944.]

The three new species described are *Tenuipalpus pseudocuneatus* and *Anychus verganii* [*cf. R.A.E.*, A **31** 476 ; **32** 61], both on *Citrus* in Corrientes, and *A. schultzi* on castor (*Ricinus communis*) in Tucumán. *T. pseudocuneatus* is stated to transmit the virus of "lepra" of *Citrus* [*cf.* **26** 581].

BAILEY (W. K.). **Experiments in controlling Corn Ear Pests in Puerto Rico.**—*Circ. P.R.* [*fed.*] *Exp. Sta.* no. 23, 23 pp., 4 figs., 5 refs. Washington, D.C., 1940. [Recd. 1944.]

In view of the development of a variety of sweet maize that can be grown in Porto Rico throughout the year, attempts were made in 1938–39 to find measures that would prevent infestation by *Heliothis armigera*, Hb., *Laphygma frugiperda*, S. & A., and *Euxesta stigmatias*, Lw., and so enable local growers to supply the New York market with fresh sweet maize during the period in which none is available from the continental United States. Of the three pests, *E. stigmatias* [*cf. R.A.E.*, A **27** 328] is the most widespread and difficult to control; infestation by this Ortalid increased in the three years preceding 1940, and in most cases reached 100 per cent. in the untreated ears examined. An account is given of the work, much of which has already been noticed [**28** 492 ; **29** 469]. In view of the results of the tests in which derris powder was added to mixtures of oil and pyrethrum extract injected into the tips of the ears [**29** 470], experiments were carried out in August and September 1939 with a proprietary derris extract and an alcoholic extract of pyrethrum containing 2·4 per cent. pyrethrins. The derris extract was employed because derris powder did not readily remain in suspension. Neither extract was effective when applied in water at a concentration of 1 : 25. Where they were applied in mineral oil, either separately or as a mixture of equal parts of each, at a concentration of 1 : 25, there was little difference between the numbers of uninfested ears and of ears infested by the Noctuids, but infestation by *Euxesta* was significantly higher in ears treated with derris than in those treated with pyrethrum. Pyrethrum gave approximately the same control of *Euxesta* when used alone or in combination with derris, but this never reached 50 per cent. In tests in which the extracts were used in oil at various concentrations, infestation by *Euxesta* was again significantly higher following treatment with derris than with pyrethrum or the mixture of the two. All three treatments gave commercial control of *Euxesta* at a concentration of 1 : 5, and pyrethrum at 1 : 10 ; of ears treated with pyrethrum, the mixture and derris, each at 1 : 5, 1·7, 3·3 and 10 per cent., respectively, were infested by *Euxesta*, and 13·3, 0 and 0 per cent. by the Noctuids. At all concentrations except the lowest tested (1 : 40), derris was more effective against the latter than pyrethrum. Derris alone or in the mixture with pyrethrum was superior to pyrethrum alone for the control of the three pests considered together, but its use is not recommended as both derris and the mixture scorched the husks severely when used in oil at concentrations of 1 : 5 and 1 : 10. The injury was particularly severe when the derris was used alone. A few ears were scorched by pyrethrum in oil at a concentration of 1 : 5, but the injury was not such as to preclude its use on a commercial scale.

On the basis of the whole series of experiments, which were carried out under weather conditions varying from severe drought to excessive rainfall, a single application of pyrethrum extract in oil at a concentration of 1 : 5 is recommended against all three pests, and it is suggested that two applications might be still more effective, particularly where the Noctuids are abundant. As the mixture interferes with pollination, it should not be applied until the silks begin to dry at the tips. Larvae of *H. armigera* frequently migrate from ear to ear, and it is therefore probably desirable to treat all the ears in a field at a time, regardless of size, or to treat the marketable ears and remove the others immediately.

[**Entomological Investigations and Biological Control.**]—*Rep. P.R.* [*fed.*] *Exp. Sta. 1940* pp. 65–85, 6 figs., refs. ; *1941* pp. 19–23, refs. ; *1942* pp. 12–17, refs. Washington, D.C., 1941–43. [Recd. 1944.]

Each of these reports contains a section dealing with work on biological control in Porto Rico by K. A. Bartlett and one on insect pests in general by

H. K. Plank. Rearing of the introduced parasites, *Metagonistylum minense*, Tns., and *Theresia claripalpis*, Wulp (*Paratheresia diatraeae*, Brèth.) for liberation against *Diatraea saccharalis*, F., on sugar-cane was continued [*cf. R.A.E.*, A **29** 470]. Among the adults of the São Paulo strain of *M. minense* received from Brazil and among the progeny of melanic females of this strain from Barbados, a few individuals were observed in 1940 in which the abdomen had a reddish tinge; this was found to be a recessive character. The gestation period of the São Paulo strain lasted 24–48 hours longer than that of the Amazon strain, and this may explain its lower fecundity [**29** 4]. The numbers of larvae of *D. saccharalis* that were inoculated with larvae of the São Paulo strain, the Amazon strain from Brazil, and a stock of the Amazon strain collected in British Guiana and acclimatised in St. Lucia, together with the numbers of adults of each strain that were reared and liberated at each of eight places during the year are shown in tables. The parasites recovered from field-collected larvae of *D. saccharalis* during 1940 comprised newly-liberated *M. minense*, *Agathis* (*Bassus*) *stigmatera*, Cress. [*cf.* **29** 470] and the native species, *Lixophaga diatraeae*, Tns. *M. minense* was recovered from four liberation sites, but the rate of parasitism was low. The Amazon strain was established along the southern coast, where the São Paulo strain was becoming established, and spread considerably during the year. In 1941, 2,591 adults of the São Paulo strain were liberated, and both strains were recovered from four places, at which percentage parasitism varied from 0·5 to 6·1; it was as high as 46 in larvae of *D. saccharalis* infesting maize at one locality. Rearing was discontinued in October 1942, but liberations of the São Paulo strain were made in August–November. The rate of parasitism by both strains in the field did not exceed 1 per cent.

Mass rearing of *T. claripalpis* is limited by the difficulty with which mating occurs in the laboratory and the high mortality during the gestation period, which occupies 13–15 days. A highly successful mating technique was evolved in 1940 in which the sexes were isolated for at least 48 hours from the time of emergence and then kept in a bright light until the males became active, when each was placed with a female in a narrow vial. Records are given of the numbers of adults obtained by laboratory rearing and the numbers liberated in each of the three years, and of the numbers obtained from puparia received from Brazil in 1941, and in 1942, when the majority proved to be parasitised. Other parasites of *D. saccharalis* introduced during 1942 were *A. stigmatera* and *Ipobracon amabilis*, Brèth., from São Paulo, of which 27 and 57 adults, respectively, were liberated.

A small breeding stock of *Coelophora inaequalis*, F., which was introduced against *Sipha flava*, Forbes, on sugar-cane in 1938 [*cf.* **27** 382; **29** 471], was maintained during 1940, when releases were made at six points. This Coccinellid appeared to be established at several places in 1941, when it attacked Aphids of all species, and was found in large numbers feeding on *S. flava* in 1942. *Pseudaphycus utilis*, Timb., which was introduced against *Pseudococcus nipae*, Mask., on avocado, guava and palms, etc., in 1939 [**29** 472] increased to such an extent that the host was extremely difficult to find in 1940. Of the parasites introduced against *P. brevipes*, Ckll., on pineapple [**29** 472], *Hambletonia pseudococcina*, Comp., was found to be established in several districts in 1940 and considerably reduced the numbers of its host in one of them, and *Anagyrus coccidivorus*, Doz., was recovered in one of two places in which it was released.

Of the Coccinellids introduced against *Asterolecanium bambusae*, Boisd., and *A. miliaris*, Boisd., on bamboo [**28** 493; **29** 471], one of the commonest in 1940 was *Egius platycephalus*, Muls., which occurred in large numbers throughout the island. It was liberated at two places during the year, and adults collected in September were shipped to Haiti and liberated there. *Cladis nitidula*, F., which was introduced from Martinique and was previously recorded as *Curinus* sp.

[**28** 493] was well-established in a number of places; it chiefly attacks *A. bambusae*. The species of *Curinus* from Trinidad was also well-established in several localities, where it chiefly attacked *A. miliaris*. In addition to feeding on bamboo scales, *Pentilia castanea*, Muls., commonly attacked *Pseudaulacaspis* (*Aulacaspis*) *pentagona*, Targ., on papaya and various Coccids on *Citrus*. *Chilocorus cacti*, L., was particularly effective against *P. pentagona* on papaya, and large colonies were observed several miles from the nearest liberation points; this species prefers heavy infestations of Coccids, and it disperses as the latter die out, but it is of considerable value owing to its ability to seek out heavy infestations and to increase rapidly on them. One liberation each was made of *Pentilia castanea* and field-collected *C. cacti*. In June 1940, adults of *Exochomus jourdani*, Muls., were received from Brazil, where they had been found feeding on species of *Asterolecanium* on bamboo. Some were released at once and others reproduced in cages containing bamboo culms infested with *A. bambusae*, from which the new generation was allowed to escape. The other five introduced predators gave effective control of the bamboo scales, particularly *A. bambusae*, in 1941, and also preyed on other Coccids, including *Prontaspis* (*Chionaspis*) *citri*, Comst., and *Lepidosaphes beckii*, Newm., on *Citrus*, *Pseudaulacaspis pentagona* on papaya, and *Ischnaspis longirostris*, Sign., on coconut; *Chilocorus cacti* was observed in large numbers feeding on *Coccus viridis*, Green. In 1942, when the commonest species were *Egius platycephalus*, *Chilocorus cacti* and *Pentilia castanea*, they also reduced the numbers of *Aspidiotus destructor*, Sign., on coconut. *E. platycephalus* was particularly effective against the bamboo scales, as it can maintain itself on very low populations and completely destroys one infestation before attacking another. A shipment of 230 larvae of *Azya* sp., another Coccinellid predacious on Coccids, was received from Brazil in 1942, but they arrived in poor condition and many were parasitised. Only 26 adults were reared. They failed to reproduce in cages enclosing leaves of coffee heavily infested with *Coccus viridis*, and six that were still alive after 20 days were liberated.

In 1940, *Diversinervus* sp., *Mesopeltis* sp., *Metaphycus helvolus*, Comp., and *M. stanleyi*, Comp., all of which are African parasites of *Saissetia oleae*, Bern., were received from California. Their rearing was begun, and 50 adults of *Mesopeltis* sp. were released. A consignment of 38 puparia and 55 adults of Dipterous parasites of various Pentatomids was received in October 1941 from Chile, but only 31 adults of *Ectophasiopsis arcuata*, Big., and nine of *Cylindromyia porteri*, Brèth., were alive on arrival, and the females of the latter died without ovipositing. The adults of *E. arcuata* mated and the females oviposited readily in various Pentatomids and Coreids, but no larvae developed. Prior to May 1939, a stock of *Dasyscapus parvipennis*, Gah., was maintained in the laboratory [**28** 94], and frequent liberations were made in various parts of the island. In 1941, this parasite was found to be attacking large numbers of *Selenothrips rubrocinctus*, Giard, on tropical almond (*Terminalia catappa*) and mango, and it also occurred in smaller numbers at two other points. Of the two species of *Dysdercus*, *D. andreae*, L., and *D. sanguinarius*, Stål, that occur on cotton in Porto Rico, only the first is of importance. Shipments of adults and puparia of *Acaulona peruviana*, Tns., and *Hyalomyia chilensis*, Macq., reared from *D. ruficollis*, L., in Peru, were received in Porto Rico in 1942. A few hyperparasites of the genus *Perilampus* emerged from some of the puparia. Both parasites mated when kept in cloth cages in light of medium to strong intensity, and females of *A. peruviana* oviposited readily in both species of *Dysdercus*. *D. andreae*, which is smaller than *D. sanguinarius*, was preferred for oviposition, but rearing was difficult and mortality high, and the stock died out in November. Females of *H. chilensis* were not observed to oviposit. Both species were released at various sites between July and October, and two examples of *A. peruviana* were recovered at one of them in the following May.

Material shipped to other countries during the three years under review included consignments of *Metagonistylum minense* to Barbados in 1940, Louisiana in 1941, and Guadeloupe in 1941 and 1942; a small shipment of *T. claripalpis* to Cuba in 1941; a consignment of the predacious Coccinellids, *Cycloneda sanguinea* var. *limbifera*, Csy., and *Coelophora inaequalis*, to Guatemala in 1942; and adults of *Bufo marinus* to Cuba in 1940. Parasites and predators reared in California from a shipment of *Saissetia nigra*, Nietn., collected in Porto Rico in 1940 comprised *Scutellista cyanea*, Motsch., *Eupelmus coccidivorus*, Gah., *Lecaniobius cockerelli*, Ashm., *Coccophagus scutellaris*, Dalm., *Aneristus ceroplastae*, How., *Marietta* sp., and *Scymnus flavifrons*, Melsh.

Investigations on the bionomics and control of the Bostrychid, *Dinoderus minutus*, F., infesting harvested culms of bamboo, were continued in 1940 [*cf.* **28** 494; **29** 472, etc.] and are described in detail. The adults were found to tunnel chiefly in the pith between the fibro-vascular bundles, which usually contains much starch; the severity of attack varied directly with the amount of this tissue present. They often enter with the grain of the wood, as from a cut end, and then construct tunnels at right angles that may eventually extend all round the culm. Many small larvae were observed in one-year-old culms of *Bambusa vulgaris* that had been exposed to infestation for about six weeks, boring in the pith between the bundles and close to the horizontal tunnels containing adults. The eggs from which they hatched were deposited singly in the vessels of the vascular bundles, evidently those severed during the construction of the horizontal oviposition tunnels, and the entrances to the vessels were blocked with frass. Adults caged with split grains of sweet maize appeared to feed normally and oviposited freely in the frass produced. The eggs differed very slightly in size and shape from those laid in bamboo; they shrank slightly during incubation, but the larvae from them were normal. At an average temperature of 79°F., the incubation period occupied 3–7 days. The parasite, *Doryctes* [*parvus*, Mues. (**30** 362)], was observed in association with *Dinoderus minutus* in Porto Rico in 1936 and 1940, but appeared to be scarce.

Treatment of the culms by a sap-stream injection method [**28** 494] with solutions of copper sulphate, mercuric chloride and hydrochloric acid, which hydrolyses starch, used at concentrations of 333·21, 14·5 and 20 gm. per litre, respectively, and applied at the rate of 1 litre of solution per cu. ft. of culm volume reduced subsequent infestation by 96, 83 and 65 per cent., respectively, as compared with untreated culms. Clump curing (cutting the culm and leaving it upright without chemical treatment), which was previously the most effective measure [**28** 494], gave only 61 per cent. reduction. Except where copper sulphate was used, there appeared to be inherent differences in susceptibility to attack among culms of the same age in different clumps. Infestation was significantly least severe in the top internodes of all culms, much more severe in the bottom than the middle internodes of clump-cured culms, nearly as severe in the bottom as the middle ones in culms treated with copper sulphate or mercuric chloride, in spite of the probably higher concentration of the chemicals there, and most severe in the middle in untreated culms. Starch was shown to be most abundant in the middle internode in most of the untreated culms, and in the bottom internode of the treated ones. This distribution of starch in untreated culms was confirmed in 1941, when several species of bamboo were tested; the strongest reaction was given in the most susceptible kinds of bamboo, and attacks were more than seven times as numerous in the middle and bottom internodes as in the top. Some evidence was also obtained in 1940 that attacks are associated with a high moisture content of the wood. All the three chemicals tested affected the colour of the wood, and copper sulphate and mercuric chloride in bamboo are likely to corrode metals with which they come in contact. Hydrochloric acid affected the texture of the wood and made it brittle and easily splintered. Studies of the frass in untreated and treated wood and of the contents of the digestive tract of the beetles indicated that the latter ingest only part of the material that they bite off in constructing their tunnels and reject the rest in the form of splintered material. Insecticides encountered while boring may therefore be avoided to some extent. It appeared from other investigations, including some on the progress of infestation and mortality of larvae in treated wood, that copper sulphate is more evenly distributed in the wood than mercuric chloride and that this offsets its lower toxicity. In tests of the resistance of bamboos in 1941, the average susceptibility, compared with *B. vulgaris*, of *B. tuldoides*, *Dendrocalamus giganteus*, *B. polymorpha* and two varieties of *B. tulda* were 9·24, 6·67, 16·76, 2·18 and 2·35 per cent., respectively.

It is stated in the report for 1941 that *Kalotermes brevis*, Wlk., has been controlled by injecting orthodichlorbenzene or a saturated solution of paradichlorbenzene in kerosene into the colonies in timber. These were later diluted with an equal quantity of a solution of 5 per cent. pentachlorphenol in kerosene or a light diesel fuel oil to render the wood resistant to future attack. Treatment with these materials over a period of three years almost eliminated a heavy infestation in a house, and one year's treatment greatly reduced heavy infestation in another building. In 1942, two other species, *K. cavifrons*, Banks, and *K. snyderi*, Light, were found to be present at one of these infestations. Collections at light during the previous six years showed that a few adults of *K. brevis* and *K. cavifrons* were present in January and February, but they usually swarm in April–May, and March, respectively. *K. snyderi* swarms in early May.

Previous attempts to control larvae of *Euxesta stigmatias*, Lw., in sweet maize by injecting white mineral oil into the ears were unsuccessful unless pyrethrum extract was incorporated into the oil [see preceding abstract], but in view of the development of a new type of injector and the successful substitution of dichlorethyl ether for pyrethrins against *Heliothis armigera*, Hb. [**29** 217], further experiments were carried out in 1942. Mineral oil alone or containing 2, 4 or 6 per cent. dichlorethyl ether by volume was applied when the silks began to wilt and dry, and the application was repeated in some cases five days later. After 11 days, untreated ears contained larvae of *E. stigmatias*, *H. armigera* and *Laphygma frugiperda*, S. & A.; none of the treatments controlled *E. stigmatias* or prevented infestation by the other species, although the injector was satisfactory. Control of *H. armigera* and *L. frugiperda* increased with increasing concentrations of dichlorethyl ether, but two applications of oil containing 4 or 6 per cent. were the only treatments that gave commercial control, and these caused considerable injury to the husks and sometimes the tips of the cobs.

Pseudococcus brevipes was found on soy beans in September and October 1942; large colonies had developed round the crowns of most of the plants in a field and had extended in some cases on the roots to about 6 ins. below the surface of the soil and round the nodes of the stems to a height of about 2 ft. *Solenopsis geminata*, F., was associated with all the colonies and in most cases had constructed nests close at hand. Since this ant increases infestation by *P. brevipes* [**29** 346], an attempt was made in January to control both in another field of young soy beans, about half of which were infested by colonies containing almost mature mealybugs, with no young ones or eggs. An emulsion prepared by dissolving 8 oz. hard soap in 1 U.S. quart water, stirring in 1 U.S. pint crude carbolic acid, and adding enough water to bring the volume to 2 U.S. quarts was used at a concentration of 1 pint in 6 gals. spray. The spray was applied at a rate sufficient to puddle the soil round the crown and upper roots of the plants, and also directed on to any colonies of mealybugs or ants encountered. Only a few plants were heavily infested with mealybugs, and ants were associated with some of the heavy infestations and none of the light ones. The treatment reduced the number of heavy infestations associated with ants by 77 per cent., but had little effect where ants were not present.

In 1941, the Coccids, *Howardia biclavis*, Comst., and *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), damaged *Cinchona*, especially weak plants, in one district, but were satisfactorily controlled by a thorough application of a light oil emulsion at a concentration of about 1 per cent. *Aphis rumicis*, L., caused considerable injury to *Senecio confusus*, an extensively-planted ornamental, from August until well into the winter, and *Macrosiphum sonchi*, L., which has not previously been recorded in Porto Rico, was found on the same plant in June. In 1942, *Ormenis marginata*, Brunn. (*pygmaea*, F.) was abundant on *S. confusus* and *Jasminum azoricum* in winter and spring, causing stunting and die-back of the branches and extensive development of sooty mould ; *Apate francisca*, F., killed one-year-old trees of *Cola acuminata* in February ; and *Elasmopalpus lignosellus*, Zell., hollowed the stems of most of the seedlings in a large planting of velvet beans [*Stizolobium*] in April.

Service and Regulatory Announcements, October-December 1943.—*S.R.A., B.E.P.Q.* no. 157 pp. 37–43. Washington, D.C., U.S. Dep. Agric., 1944.

Information in this part includes a supplement to plant quarantine import restrictions already noticed in Brazil and a revised supplement to restrictions already noticed in Mexico.

Black (L. M.). **Some Viruses transmitted by Agallian Leafhoppers.**—*Proc. Amer. phil. Soc.* **88** no. 2 pp. 132–144, 7 figs., 25 refs. Philadelphia, Pa., 1944.

Since *Aceratagallia sanguinolenta*, Prov., transmits only the New York variety of the yellow-dwarf virus of potato (*Marmor vastans* of Holmes, var. *vulgare* of Black) and *Agallia constricta*, van D., only the New Jersey variety (*M. v. agalliae* of Black) [*cf. R.A.E.*, A **31** 4, 276], it was thought that closely related leafhoppers might be vectors of other yellow-dwarf viruses and that this might be determined by feeding them on suitable hosts. Examples of *Agalliopsis novella*, Say, were therefore taken in the field near Washington, D.C., and in New Jersey and tested on crimson clover (*Trifolium incarnatum*), and two apparently new viruses were discovered [**32** 153]. One, called clover big-vein virus, was transmitted by leafhoppers taken near Washington, and the other, called clover club-leaf virus, by those taken in New Jersey. Both appeared closely related to the New York and the New Jersey varieties of potato yellow-dwarf, and a new genus, *Aureogenus*, is erected for these four viruses. The big-vein and club-leaf viruses are named *A. magnivena*, sp. n., and *A. clavifolium*, sp. n., respectively. Experiments showed that *A. vastans vulgare* was transmitted from infected to healthy crimson clover by *Aceratagallia sanguinolenta*, *A. lyrata*, Baker, *A. obscura*, Oman, and *A. curvata*, Oman, but not by *Agallia constricta*. It was transmitted by only 2 of 465 individuals of *Agallia quadripunctata*, Prov., and possibly by 1 of 220 of *Agalliopsis novella*. *Aureogenus vastans agalliae* was transmitted by *Agallia constricta* and *A. quadripunctata*, but not by *Aceratagallia sanguinolenta*. Possibly 1 of 241 individuals of *Agalliopsis novella* transmitted it. *Aureogenus magnivena* was transmitted by *Agallia constricta*, *A. quadripunctata* and *Agalliopsis novella*, but not by *Aceratagallia sanguinolenta*. *Aureogenus clavifolium* was transmitted by *Agalliopsis novella* but not by *Aceratagallia sanguinolenta*, *Agallia constricta* or *A. quadripunctata*.

The relationships of the viruses are discussed. Both varieties of *Aureogenus vastans* are readily transmitted mechanically to *Nicotiana rustica* and cause similar symptoms in *N. rustica* and potato, but attempts to transmit the new viruses to *N. rustica* were unsuccessful and no symptoms were produced in potatoes on which *Agallia constricta* carrying the big-vein virus or *Agalliopsis novella* carrying the club-leaf virus had fed.

Ditman (L. P.), Cory (E. N.), Graham (C.) & White (A.). **Pea Aphid Studies in Maryland.**—*Bull. Md agric. Exp. Sta.* no. A24 pp. 359–378, 2 graphs., 14 refs. College Park, Md., 1943.

The results are given in detail of investigations carried out on the Eastern Shore of Maryland during 1938–42 to determine the extent of yearly injury caused to Alaska or Early June peas by the pea Aphid [*Macrosiphum onobrychis*, Boy.] and the economic practicability of regular annual treatments for its control. In Maryland, the Aphid overwinters on perennial species of clover (*Trifolium*) and lucerne, particularly the latter. It is probable that part of the winter is spent in the egg stage in the west of the State, but no eggs were found on lucerne on the Eastern Shore in February 1942 and 1943, though all other stages were present. They were most abundant deep in the rosettes of lucerne plants where they were protected by grass, leaves and other plant débris, and rare in fields in which there was no dead plant material and the rosettes of lucerne were openly exposed. In spring, the Aphids moved to the first tender shoots of the winter food-plant, where they reproduced. In 1942, reproduction of overwintered females was first observed on 1st April, winged adults on lucerne on 20th April, migrants on peas on 24th April and young on peas next day, when the plants were 3–4 ins. high. Lucerne, peas and vetch seem to be preferred to red and crimson clover [*T. pratense* and *T. incarnatum*], which are rarely attacked severely. Infestation was heaviest on vigorous plants able to support high populations and in the absence of temperatures above 90°F. The atmospheric temperature when the Aphids were developing on their winter food-plants, from the middle of March until the latter part of April, determined the time of migration to peas and to a considerable extent the amount they were injured; populations persisted longer during cool seasons favourable for pea growth than during dry hot seasons.

The control measures were most valuable when Aphid infestation began early and climatic conditions favoured pea growth. Sprays containing 3–4 lb. ground derris root (4 per cent. rotenone) and $\frac{1}{4}$–$\frac{1}{2}$ lb. sodium lauryl sulphate per 100 U.S. gals. water, applied at the rate of 150 U.S. gals. per acre, increased the average yield by 493 lb. shelled peas per acre, which was considered satisfactory, the net return being more than double the cost of treatment. There appeared to be no great difference in effectiveness between the derris spray and a derris dust containing 1 per cent. rotenone, or between day and night application of the dust during seasons with sufficient rainfall, both temperature and contact moisture (dew) at the time of treatment being of little importance in the effectiveness of derris, but on the Eastern Shore, persistent high winds during most of the day make early morning treatments preferable. Dusts and sprays of cubé were less effective, but were improved by fine grinding [*cf. R.A.E.*, A **29** 202], and nicotine sprays and vapour were superior to rotenone-bearing materials [*cf.* **30** 260–261], but nicotine dusts gave less control, probably because too little dust was used and the apron on the duster was too short; water sprays were the cheapest method of applying nicotine. Analysis of the results obtained during the five years showed that the effectiveness of rotenone materials varied from year to year; the temperature, before, during and after treatment had little if any effect on the percentage kill, but increased rainfall before and after treatment resulted in increased efficiency.

The effects of Aphid infestation on the quality of the peas and of the group of mosaic diseases carried by *M. onobrychis* on their yield are discussed. There was no evidence that the yield of Alaska peas was reduced when these diseases were prevalent, but they severely injured a large-vined variety of sweet pea [*Lathyrus odoratus*].

WILBUR (D. A.), BRYSON (H. R.) & PAINTER (R. H.). **Southwestern Corn Borer in Kansas.**—*Bull. Kans. agric. Exp. Sta.* no. 317, 32 pp., 18 figs., 5 refs. Topeka, Kans., 1943.

By 1942, *Diatraea grandiosella*, Dyar, was found to be infesting maize in 51 of the western counties of Kansas, from Nebraska to Oklahoma, and was firmly established in the south-western part of the Maize Belt [*cf. R.A.E.*, A **31** 340]. In this State, only maize and sorghum are attacked. Infestation was heaviest in a strip about 100 miles wide and extending between Barber and Ellis counties, in which it was found in all the fields examined and in 80–100 per cent. of the stalks in all but early planted fields. All stages of the moth are briefly described, and its distribution in the United States and Mexico is recorded.

In 1942, overwintered larvae pupated in June and the moths emerged a few days later. These probably oviposited during late June and early July in south-central Kansas. The eggs were laid from the tip to the base of both surfaces of the leaves below the whorl. Most of the larvae from these eggs were less than half-grown and still round the central bud or whorl on 15th July, but several pupae were found ten days later at the base of their tunnels in the stalks. By the beginning of August, most of the first-generation larvae had pupated, and some moths had emerged. Eggs were deposited during the first half of this month, and by the middle of September, second-generation larvae were approaching maturity and some were girdling stalks and preparing cells in which to hibernate [*cf. loc. cit.*]. Numerous small larvae that were observed feeding on the buds in the axils of the lower leaves at this time may represent a third generation, but it is unlikely that they matured. Girdling by larvae about to overwinter was observed on various internodes up to the seventh, and occasional stalks were girdled in two places, usually in different internodes. In April 1942, as many as 28 per cent. of the hibernating larvae had survived, and in April 1943, the survival varied from 2 per cent. in northern Kansas to 32 per cent. in the south. At the same time, it was observed that the larvae overwinter in sorghum stubble with a percentage survival as high as that in maize, or even higher. During summer, migration to other tillers on the same plant or to other stalks on the same hill apparently took place, particularly in sorghum, but migration across the ground to neighbouring maize or sorghum plants was not observed.

The injury caused to maize by feeding on the leaves, feeding on or about the terminal bud within the whorl, boring within the stalk, boring into the shanks and ears, and the internal girdling of stalks, which is the chief source of damage in Kansas, is described in some detail. Medium-planted maize that was attacked by both generations had three times as many borer holes per stalk as maize attacked only by the second generation, and more than three times as many as early-planted maize. Recommended control measures comprise replacing maize by sorghum, which, since it is relatively unattractive to ovipositing moths and does not provide so suitable a habitat for the larvae, is unlikely to become heavily infested, early planting, late autumn treatment of stalks and stubble and deep ploughing of stubble [*cf. loc. cit.*], cutting the maize at or near the surface of the soil by early September, which will remove many borers from the field before they become established in hibernation cells, and the development of resistant varieties of maize. No parasites were found in Kansas, though some that are not known to occur there were reared in New Mexico and Arizona, and these may possibly be introduced. Ants were seen to feed on dead larvae, and birds, such as woodpeckers, opened some infested stalks. A number of larvae, both before and after hibernation, were infected with bacteria or fungi, but it is not known whether these were parasitic or saprophytic.

Methods are given for distinguishing larvae of *D. grandiosella* from those of *D. crambidoides*, Grote, *Heliothis armigera*, Hb., *Laphygma frugiperda*, S. & A., *Papaipema nebris*, Gn. (*nitela*, Gn.), and species of *Sphenophorus* (*Calendra*), all of which infest maize in Kansas.

WHITCOMB (W. D.), TOMLINSON jr. (W. E.) & GUBA (E. F.). **The Grape Plume Moth, with Notes on other Pests of Grapes in Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 409, 20 pp., 6 figs., 1 graph, 15 refs. Amherst, Mass., 1943.

In the first part of this bulletin (pp. 3–13), Whitcomb and Tomlinson give an account of the bionomics of *Pterophorus* (*Oxyptilus*) *periscelidactylus*, Fitch, in eastern Massachusetts and of investigations on its control, much of which has been noticed from a preliminary report [*R.A.E.*, A **29** 133]. Brief descriptions of all stages of this moth and an outline of its distribution in North America are included. It has become abundant in eastern Massachusetts, despite the scarcity of commercial vineyards, because grape-vines are common in gardens, where they are seldom systematically pruned, and the resulting dense growth provides conditions favourable for it. It occurs only on wild or cultivated forms of *Vitis labrusca*, chiefly the latter, and in 1939–42, more than half of the tips of garden vines were found to be regularly infested. An average of 3–19 eggs per node was found on a sample of 102 infested nodes from a normally infested vine, but this represents an infestation of only 8 per cent. on all the canes, since no eggs are laid on the current ones. The pupal period, which usually occupies 9–13 days, was prolonged to 12–27 days by cool weather in 1940. Five parasites, *Horismenus microgaster*, Ashm., *Hypopteromalus inimicus*, Mues. (which was in this case definitely a primary parasite), *Campoplex* sp., *Bracon* (*Microbracon*) sp., and an undescribed species of *Apanteles*, were reared from the larvae, but they were of no importance in control. Careful annual pruning by a recommended system removes 70 per cent. of the eggs and provides an important check to infestation [**32** 252]; hand-collecting the larvae or the webbed leaves containing them is a commonly adopted measure on garden vines, but does not prevent infestation from developing each year. In laboratory tests in 1939–40 and field trials in 1939–42, lead arsenate sprays were found to be of no value in control [*cf.* **22** 28], but a 1 per cent. solution of Elgetol (a preparation containing sodium dinitro-ortho-cresylate) and oil emulsion diluted to contain 3 per cent. oil were both satisfactory [**29** 133]; a 0·5 per cent. solution of Elgetol was ineffective. The recommended date of application is 15th April.

In the second part (pp. 14–20), Whitcomb and Guba give brief notes on the appearance and control of eight other insects and three fungous diseases that attack grape-vines in Massachusetts, and on the bionomics of some of the insects. The most important is *Macrodactylus subspinosus*, F., against which a spray of 5 lb. lead arsenate in 100 U.S. gals. water is effective, particularly if 2 U.S. gals. molasses are added to it. *Polychrosis viteana*, Clem., and *Fidia viticida*, Walsh, which are seldom destructive in Massachusetts, and *Haltica chalybea*, Ill., which is injurious in some parts in early spring, can be controlled by sprays of Bordeaux mixture (4 : 4 : 50) containing 3 lb. lead arsenate per 100 U.S. gals., preferably with the addition of fish oil or raw linseed oil, as an adhesive, applied just after the blossom period and again when the young grapes nearly touch in the clusters. Where *H. chalybea* is abundant, a spray of 4 lb. lead arsenate in 100 U.S. gals. water should be applied shortly before the buds open. Later sprays against second-generation larvae of *P. viteana* should be avoided where possible. A lead arsenate spray is also recommended against *Ampeloglypter ater*, Lec., to prevent girdling of the canes, but applications must be repeated every three or four days [*cf.* **31** 430]; the eggs and larvae can be destroyed by nipping off the cane 2–3 ins. below the point of girdling. The spray of 6 lb. lead arsenate and 4 lb. flour in 100 U.S. gals. water recommended against adults of *Popillia japonica*, Newm., may leave considerable residue, and a repellent spray of 20 lb. hydrated lime and 3 lb. aluminium sulphate in 100 U.S. gals. may therefore be preferred. *Erythroneura comes*, Say, which is usually present, but not always abundant, and *Aphis* (*Macrosiphum*) *illinoisensis*, Shimer, are controlled by a spray of nicotine sulphate (1 : 800) ; it is most effective against the Jassid if applied when the nymphs are half-grown, generally in late June, but a further application about 1st September may be necessary. A spray-schedule for vines and a list of less important pests and diseases are appended.

Hough (W. S.). **Development and Characteristics of vigorous or resistant Strains of Codling Moth.**—*Tech. Bull. Virginia agric. Exp. Sta.* no. 91, 32 pp., 9 figs., 20 refs. Blacksburgh, Va., 1943.

Infestation of apples by the codling moth [*Cydia pomonella*, L.] in orchards in Virginia has not decreased during the past 20–25 years, despite increases in the volume of spray applied per tree, the number of applications and the concentration of lead arsenate, improvements in the quality of lead arsenate and in spraying equipment and spray formulae, and the use of supplementary control measures, and a similar, but still more pronounced, trend is noticeable in the orchard areas of the Pacific Northwest, the Grand Valley of Colorado and New Jersey. In view of this, and the demonstration of the existence of strains resistant to insecticides [*R.A.E.*, A **22** 499, etc.], a study, here described in detail, was made in 1934–42 of the occurrence and development of resistance in local populations, the effect of environment on its degree, and the nature of the difference between the strains.

The following is based largely on the author's summary and conclusions. In comparative tests between larvae from sprayed (commercial) and unsprayed orchards in 1934–35, the larvae from the former were better able to enter fruit sprayed with lead arsenate, cryolite or nicotine bentonite than those from the latter, the average percentage of living larvae entering the sprayed fruit being 2–5 times as great. The other tests were made with four laboratory strains designated Virginia, Bly, Blue Ridge, and Nicodemus, reared almost exclusively on unsprayed fruit and K strains isolated from them in 1929 [*cf. loc. cit.*], 1935, 1936 and 1936, respectively, and reared on apples treated with lead arsenate. The two Nicodemus strains originated from a sprayed orchard and all the others from unsprayed ones, but the Virginia strain had been supplemented with larvae from sprayed fruit. Within 1–3 years, the K strains differed from the parent strains in ability to enter fruit sprayed with lead arsenate, cryolite, nicotine bentonite or phenothiazine. It appeared that Virginia-K had reached the maximum degree of resistance possible to it in 1943 and that the other K strains had not. Ability to enter sprayed fruit was most marked in the Virginia-K and least in Blue Ridge and Bly, with Blue Ridge-K, Bly-K, Nicodemus-K, Nicodemus and Virginia in intermediate positions. Larvae from a commercial sprayed orchard in one county and an abandoned commercial orchard in another resembled larvae of the Nicodemus and Virginia strains, which are believed to be representative of populations in commercial orchards in northern Virginia.

In studies of the factors influencing resistance, the number of living larvae of both the Virginia and Virginia-K strains to enter the fruit was reduced by high humidity. This, however, did not eliminate the superiority of the K strain. Fewer larvae of the Virginia-K strain dropped to the ground or wandered away from suspended apples before entering the fruit than of other strains, but this difference was not sufficient to explain the greater number of entries by this strain and is regarded rather as a manifestation of its general vigour, to which resistance is attributed. Neither competition among several larvae in a single apple, which occurs more frequently in neglected or abandoned orchards than in sprayed ones, nor rearing the larvae on apples from which the cores were removed influenced the ability of the larvae of the following generation to enter sprayed fruit ; the average weight of full-fed larvae reared on core-less apples was 21·3–26·7 per cent. less than that of mature larvae reared on whole apples, and the moths to which they gave rise were smaller. The average numbers of eggs deposited in breeding cages by females of the Virginia-K, Blue Ridge-K and Bly-K strains exceeded those deposited by females of the strains from which they originated. The rates of oxygen consumption by individuals of the Virginia-K and of the four parent strains were measured to provide an index to their rates of metabolism. The metabolic rate in larvae that were about to hatch was lowest in the resistant Virginia-K strain and highest in the least resistant Blue Ridge and Bly strains. It was lower in full-fed larvae and higher in adults of all strains, and was still lowest in the Virginia-K strain in both cases, but the differences between the strains were not significant. The weight of the eggs, but not of the full-fed larvae or adults, was found to vary directly with the resistance of the strain.

YOUNG (H. D.), CARTER (R. H.) & SOLOWAY (S. B.). **Bromine Residues from Methyl Bromide Fumigation of Cereal Products.**—*Cereal Chem.* **20** no. 5 pp. 572–578, 10 refs. St. Paul, Minn., 1943.

The following is substantially the authors' summary. Cereal products that had been fumigated with methyl bromide were analysed to determine what bromine residues might be expected from such treatments. Samples were taken after commercial fumigations in mills or warehouses treated as a whole, in vacuum or atmospheric vaults, under tarpaulins and in box cars. The results indicate that commercial fumigation practices can be expected to increase the bromine content of flour and other cereal products. The increases ranged from practically nothing to 247 parts per million, or nearly twelve times the amount originally present. In most cases, however, the fumigated product contained less than twice the original amount. Vacuum vault fumigation apparently caused larger bromine residues than other practices.

CLARK (E. P.). **Scandenin—a Constituent of the Roots of** *Derris scandens.*—*J. organic Chem.* **8** no. 5 pp. 489–492, 5 refs. Beltsville, Md., 1943.

The following is the author's summary. The roots of *Derris scandens* have been examined for rotenone with negative results, but a new substance, scandenin, $C_{26}H_{26}O_6$, has been found. Lonchocarpic acid and possibly robustic acid have also been shown to be present. Scandenin is isomeric with lonchocarpic acid. It contains one methoxyl, two free hydroxyl groups, and probably a *p*-hydroxybenzoyl group. The acidic character of scandenin is probably due to a phenolic hydroxyl group.

MOORE (R. H.). **Derris Culture in Puerto Rico.**—*Circ. P.R.* [*fed.*] *Exp. Sta.* no. 24, 17 pp., 6 figs., 17 refs. Washington, D.C., 1943.

In a section of this circular dealing with insect pests and diseases of *Derris elliptica* (pp. 14–16), the author states that the Bostrychid, *Dinoderus minutus*, F., which attacks the dried root in Malaya [*cf.* *R.A.E.*, A **23** 89], has not been found in it in Porto Rico, though it commonly infests dried bamboo. It can be prevented from causing damage by grinding the roots as soon as they are dry and packing the powder immediately, or by cutting the fresh roots into chips, which are dried and packed with the least possible delay. Insignificant injury to the growing plants in Porto Rico has been caused by the Pyralid, *Lamprosema*

(*Hedylepta*) *indicata*, F., the Hesperiids, *Proteides mercurius pedro*, Dewitz, and *Acolastus amyntas*, F., and other insects attacking the leaves [*cf.* **26** 224; **27** 502], and by larvae of a weevil of the genus *Diaprepes*, probably *D. abbreviatus*, L., or *D. capsicalis*, Mshl., which feed on the surface of the roots.

WOLCOTT (G. N.). **An Outbreak of the Scale Insect, *Asterolecanium pustulans* Cockerell on Maga, *Montezuma speciosissima*.**—*Caribb. Forester* **2** no. 1 pp. 6–7. Rio Piedras, P.R., 1940. (With a Summary in Spanish.) [Recd. 1944.]

An extensive infestation of *Montezuma speciosissima* by *Asterolecanium pustulans*, Ckll., was observed in Porto Rico in 1940. The trunks and main shoots were rarely infested, but half the lateral branches of some of the trees were killed, and even a few scales caused the leaves to turn brown and die. Previous instances of serious infestation by this Coccid in Porto Rico have been mainly on introduced trees. It killed an apple tree 8 ft. high, ruins the appearance of *Cassia fistula* and has caused such extensive mortality of silk oaks (*Grevillea robusta*) that they have become scarce. In one instance, it spread to mulberries from silk oaks, but the infestation ceased when the latter were felled. There is some evidence that the infestation of *M. speciosissima* was due to spread from *Sciacassia siamea*, and as this tree is very susceptible to *A. pustulans* and is of limited value, its universal destruction would seem desirable.

A. pustulans is parasitised in Porto Rico by *Aspidiotiphagus citrinus*, Craw, *Mercetiella reticulata*, Doz., and *Euaphycus portoricensis*, Doz.

BROOKS (R. L.). **Note on Attacks of *Monanthia monotropidia* Stål in Trinidad.**—*Caribb. Forester* **2** no. 1 p. 7. Rio Piedras, P.R., 1940. [Recd. 1944.]

The Tingid, *Monanthia monotropidia*, Stål, has often been recorded on *Cerdana* (*Cordia*) *alliodora* in Trinidad but did not appear to be very injurious until 1939. In that year, when it was also injurious in Porto Rico [*R.A.E.*, A **29** 51], it defoliated the trees two or three times and killed the branches of many of them, while the death of the whole tree was not unusual.

MARTORELL (L. F.). **Notes on the Biology of *Mesocondyla concordalis* Hübner and its Parasites.**—*Caribb. Forester* **2** no. 1 pp. 18–19, 1 fig. Rio Piedras, P.R., 1940. (With a Summary in Spanish.) [Recd. 1944.]

Descriptions are given of the larva and adult of *Mesocondyla concordalis*, Hb., which webs the leaves of *Tabebuia* spp. and *Crescentia cujeta* in Porto Rico. Parasites previously recorded from this Pyralid are the Tachinid, *Sturmia albincisa*, Wied., and the Chalcid, *Brachymeria incerta*, Cress., and *Bracon* (*Microbracon*) *cushmani*, Mues., has recently been reared from larvae collected in south-eastern Porto Rico and on Mona Island, 15–20 cocoons being found on a single host.

PAPERS NOTICED BY TITLE ONLY.

HALLER (M. H.), SMITH (Edwin) & RYALL (A. L.). **Spray-residue Removal from Apples and other Fruits.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1752 (revd.), 21 pp., 4 figs., 2 refs. Washington, D.C., 1943. [*Cf. R.A.E.*, A **24** 272, etc.]

NEWCOMER (E. J.). **Orchard Insects of the Pacific Northwest and their Control.**—*Circ. U.S. Dep. Agric.* no. 270 (revd.), 80 pp., 83 figs., 1 ref. Washington, D.C., 1941. [Recd. 1944.] [*Cf. R.A.E.*, A **22** 29.]

NOTICES.

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